Integrated Instructional Guide

Science

Grade 6

IDAHO DEPARTMENT OF EDUCATION

Instructional Themes

- Life Science
- Earth and Space
- Physical Science
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Introduction

“When we try to pick out anything by itself, we find it hitch to everything else in the Universe”
John Muir 1911.

In the fall of 2001, the Idaho Department of Education started an ambitious project to assist districts around the state align their curricula to Idaho’s Achievement Standards. Teams of exemplary teachers, representing many Idaho school districts, came together and worked with the Department’s content specialists to write courses of study using the Standards as their foundation. The science documents produced by this project include: one each in Biology, Earth Science, and Physical Science. These documents have been well received and are helping secondary schools around the state turn the theoretical aspects of the Standards into an educational reality for the children of Idaho.

The Intermediate Instructional Guides Project is the latest phase in the Idaho Department of Education’s continuing efforts to assist districts with Standards implementation. Elementary curricula pose a significant challenge to standards implementation. Each elementary teacher is expected to address not just the science standards, but the mathematics, social studies, language arts, humanities, and health standards as well. The school day is simply not long enough to address each set of standards individually. To give students an opportunity to master all of Idaho’s Achievement Standards, integration of academic disciplines is the key. Integration makes the task not only manageable, but facilitates the depth of learning necessary to fully reach the level of understanding the standards seek to achieve. The environmental quote from John Muir at the top of this page may also have educational ramifications. When a topic in science is studied, we find that it is also has links to math, language arts, social studies and so on.

The document you are holding is offered as a template to show one way this integration can be accomplished. The Science Achievement Standards were used to provide the central themes of the document and then the standards from other documents were integrated into the thematic units in a logical and grade level appropriate manner.

There are four documents in this science–based series, one each for Grades 3, 4, 5, and 6. It is important to introduce you to the teams of teacher/authors who organized these documents. They represent the major geographic regions of Idaho. Collectively, they have over 170 years of classroom experience. While on average only 28% of Idaho’s teachers have a master’s degree, fully 55% of this team has earned an advanced degree. They are senior teachers whose talents and expertise enrich the educational experience of their students every day. The list of school, district, and state committees or organizations they have served on or chaired is truly impressive; it includes: a past president of the Idaho Science Teachers Association (ISTA), a building science coordinator, a department chair, two facilitators of Project Wild III, a member of the Achievement Standards Science Subcommittee, board members of the Idaho Space Grant Consortium, Idaho Science Teachers Association, and the Southern Idaho Science Consortium. The list of awards they have earned is equally impressive and includes: two Presidential Awards for Excellence in Mathematics and Science Teaching, the highest award our nation bestows on a teacher with special interest in math or science, two state finalists for the Presidential Award, a Christa McAuliffe Fellow, a Fulbright Memorial Fund Teacher, a GIANTS (Governor’s Industry Award for Notable Science Teaching) awardee, three ISTA regional awardees, and a list of local and school district awards. These teachers, at the invitation of the Idaho Department of Education, contributed their time and expertise in order to assist their colleagues around the state in the process of Standards implementation. They represent all of Idaho’s fine teachers who diligently strive every day to enrich the lives of their students.
In addition to the teams of teachers who actually wrote these documents, representatives from major educational programs available to Idaho teachers also contributed to this effort. The rich and varied activities from their educational programs are integrated into these courses of study. The intent was to provide a list of suggested activities for each objective that would be varied and allow teachers to meet local curricular needs while still providing a direct link to the standards being taught. I would like to extend a special “Thanks” to: Leah Bug-Townsend (NASA), John Gahl (National Project Wild), Erin Johnson (JASON Project/INEEL), Kevin Laughlin (Junior Master Gardener Program), Julie Scanlin (Project WET), and Michelle Youngquist (Project Learning Tree). Their expertise in their individual programs and their enthusiasm for this project was an essential part of the integration segment of our work.

The Intermediate Instructional Guides produced by these teams are offered to any school district seeking to align their curricula with Idaho’s Achievement Standards. These courses of study can be used just as they are or as a template at the district level to build a curriculum more suitable to local conditions. However these documents are used, they were produced with the intent of helping school districts all across the state provide Idaho’s greatest treasure, our children, with the best possible educational experience.

Kevin Collins
June 2002


Special thanks to:

Kurt Zwolfer, Bruneau Dunes State Park, for his kind cooperation in allowing access to the telescope for photography.

Ezekiel Messenger, Idaho State Department of Education, for his digital magic.
Student Evaluation Philosophy

Assessment of student progress toward mastering individual standards should be on-going and imbedded in each instructional theme. Ideally, this assessment should be formative in nature and help guide subsequent instruction. Student performance can/should be assessed in a variety of formats, including performance assessment, portfolios, and traditional testing formats. At the completion of this course an end of course summary assessment device can be used to validate student performance.

A Note About Using This Document

Our intent in writing these courses of study is to help school districts with the process of standards implementation, by providing a possible pathway to integrating the standards of the various disciplines into effective units of instruction. As teachers, we recognize the impact that the individual strengths, personal interests, and talents a teacher brings to the classroom has on instruction. Indeed it is these qualities that should guide a teacher in determining the best ways to reach his/her students. With that thought in mind, the activities listed in these courses of study should be viewed as suggestions. The sequence of themes and activities listed to meet individual standards is simply one of many paths to help students master the standards. We encourage our colleagues around the state to use freely from our work, but also encourage them to collect activities and techniques from other sources to meet the needs of their districts’ conditions.

As a group we would encourage the use of science notebooks by students to give focus to their work. The notebook can be used for the responses to the “Question of the Day”, to record lab procedures used in class, and to serve as a collection site for data tables, diagrams, and student generated conclusions based on the objective(s) of each lesson.

The processes of science, which are included in strands (Unifying Concepts of Science, Concepts of Scientific Inquiry, Technology, Personal and Social Perspectives, and Interdisciplinary Concepts) are the foundation of science and are integrated throughout each course of study. It is also helpful to note that the science standards for grades 3 and 4 are identical to each other as are the standards for grades 5 and 6. We separated the standards for these pairs of grade levels into a two-year sequence to give teachers an opportunity to guide their students into a deeper understanding of the material being covered.

These documents are the starting point for creating a standards-based system of education in Idaho. Ultimately, the person best suited to make educational decisions to guide the instruction leading students to mastery of the standards is the classroom teacher. We hope our efforts to produce this course of study will serve as a useful resource to help meet that end.

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Instructional Theme #1: Life Science

Goal statement: Understand that the cell is the building block of life forms and the basis of human body systems.

Concepts:

1. Cell Differentiation
2. Cell Organization
3. Human Body Systems
4. Heredity
Life Science

Building Blocks of Life

Concept #1: Cell Differentiation
Concept #2: Cell Organization
Concept #3: Human Body Systems
Concept #4: Heredity
Instructional Theme #1: Life Science

Concept #1: Cell Differentiation

Objectives
1. Compare and contrast plant and animal cells.
2. Know that all living and formerly living things are made from cells.

Idaho Achievement Standards

SCIENCE

618.01: Understand systems, order, and organization.
   a: Know that a system is an organized group of related objects that form a whole.

618.02: Understand concepts and processes of evidence, models, and explanation.
   c: Use models to explain or demonstrate a concept.

618.03: Understand constancy, change, and measurement.
   a: Recognize that some concepts in science do not change with time.

618.05: Understand concepts of form and function.
   a: Understand that the shape or form of an object or system is frequently related to its use or function.

621.01: Understand the cell is the basis of form and function for all living things and how living things carry out their life functions.
   a: Explore the different structural levels of which an organism is comprised: cells, tissues, organs, organ systems, and organisms.
   b: Recognize the structural differences between plant and animal cells.

627.01: Understand the significance of major scientific milestones.
   a: Understand major contributions of various scientists and researchers.
LANGUAGE ARTS

726.01: Understand and use the writing process.
   a: Understand and apply steps of the writing process:
      • brainstorm;
      • draft;
      • revise;
      • edit/proofread;
      • publish.

726.02: Write and edit for correctness and clarity.
   a: Determine and apply rules and conventions for the following:
      • grammar;
      • punctuation;
      • capitalization;
      • spelling;
      • legibility.

726.06: Write to gather, synthesize, and communicate research findings.
   a: With teacher support, incorporate a variety of technological and informational resources to do the following:
      • appropriately paraphrase, quote, and cite to avoid plagiarism;
      • formulate thesis or focus and relevant support;
      • formulate and support main idea with evidence.
   b: Present research findings.

Suggested Activities:

1. Construct a model of plant and animal cells to use for comparison.
2. Look at a plant or an animal cell under the microscope.
3. Look at pieces of cork under hand lenses or microscopes.
4. Collect 3 or 4 plant samples – tree, plant, algae, and flower. Observe the characteristics of the whole organisms to see cell differentiation. Then, carefully look at the plant. Some cells become roots, some leaves, some flowers, etc. Extend to human body cells.
5. Research stem cell biology.
6. Report on Robert Hooke, who discovered and named cells; and Anton van Leewenhoek, a cloth merchant who invented a microscope and ground lenses he used to determine quality of cloth.
Suggested Assessment:

1. Model – Each student makes sample cells with basic cell features. Flag functions on a toothpick and/or draw and label each type of cell.

2. Table – Venn diagram – Put out samples of objects with and without cells. Kids choose which ones were or are living vs. non-living or non-cellular.

3. Lab – Lab report or notebook.
Concept #2: Cell Organization

Objective
1. Trace the progression of organization from the cell level to the organism level.

Idaho Achievement Standards

SCIENCE:

618.01: Understand systems, order, and organization.
   a: Know that a system is an organized group of related objects that form a whole.

618.05: Understand concepts of form and function.
   a: Understand that the shape or form of an object or system is frequently related to its use or function.

621.01: Understand the cell is the basis of form and function for all living things and how living things carry out their life functions.
   a: Explore the different structural levels of which an organism is comprised: cells, tissues, organs, organ systems, and organisms.

625.01: Understand the relationship between science and technology, and develop the abilities of technological design and application.
   a: Know that science and technology are human endeavors interrelated to each other, to society, and to the work place.

627.01: Understand the significance of major scientific milestones.
   a: Understand major contributions of various scientists and researchers.

LANGUAGE ARTS:

726.01: Understand and use the writing process.
   a: Understand and apply steps of the writing process:
      • brainstorm;
      • draft;
      • revise;
      • edit/proofread;
      • publish.
726.02: **Write and edit for correctness and clarity.**

a: Determine and apply rules and conventions for the following:

- grammar;
- punctuation;
- capitalization;
- spelling;
- legibility.

729.01: **View for information and understanding.**

a: Use traditional and visually-presented materials (books, films, videos, Internet).

b: Use viewing skills to determine main idea and collect data.

**Suggested Activities:**

1. Create a flow chart or a pyramid showing the organization of cells. Have the students come up with other examples of this type of organization (i.e., communities, school, etc.).

2. Write a children’s story or a play to teach younger children the concept of cell organization.

3. View the *Magic Schoolbus* video on cells.


**Suggested Assessment:**

1. Flow chart - Offer students choices of how to complete a flow chart (i.e., a numeric chart, sequential pictures, etc.).

2. Write an original poem or song. Share with the class.
Instructional Theme #1: Life Science

Concept #3: Human Body Systems

Objectives
1. Describe the function of each human body system.
2. Know the major organs of the human body and their functions.

Idaho Achievement Standards

SCIENCE
618.01: Understand systems, order, and organization.
   a: Know that a system is an organized group of related objects that form a whole.
   b: Describe the function of each human body system.
618.05: Understand concepts of form and function.
   a: Understand that the shape or form of an object or system is frequently related to its use or function.
621.01: Understand the cell is the basis of form and function for all living things and how living things carry out their life functions.
   a: Explore the different structural levels of which an organism is comprised: cells, tissues, organs, organ systems, and organisms.
628.01: Understand that interpersonal relationships are important in scientific endeavors.
   a: Work in teams to solve problems.

HEALTH
823.01: Acquire the essential skills to lead a healthy life.
   g: Identify the functions and characteristics of the major body systems.

LANGUAGE ARTS
725.01: Read a variety of traditional and electronic materials for information and understanding.
   b: Search purposefully for particular information:
      - Identify literal and inferential meanings.
      - Search own background information to make meaning of text passages.
      - Based on purpose for reading, search for most important information.
In order to understand plot development in narratives, search for information about characters and setting.
In order to understand text, search for such expository text structures as cause/effect, chronological, problem/solution, classification.

h: Determine main idea or essential message within a text and identify relevant details and facts.

725.03: Read a variety of traditional, technical and electronic materials for critical analysis and evaluation.

c: Compare and contrast information from multiple sources.

725.04: Read to locate information from a variety of traditional, technical, and electronic sources.

a: Use questions to guide reading:
   • Identify type of information required to answer a specific question.
   • Use reasonable resources for answering question.
   • Read for purpose of answering specific questions.

c: Synthesize what has been read:
   • Identify main idea and supporting details.
   • Identify important information, patterns, and themes.
   • Connect new information with prior knowledge to enhance understanding and memory.
   • Ask new questions.
   • Use prior knowledge and text information to draw conclusions, make critical judgments, and form unique interpretations from text.

725.05: Read for technical information.

a: Read, understand, and apply technical information.
b: Identify and use comprehension strategies to understand technical text.

726.01: Understand and use the writing process.

a: Understand and apply steps of the writing process:
   • brainstorm;
   • draft;
   • revise;
   • edit/proofread;
   • publish.

b: Write in a variety of formats to record, generate, and reflect upon ideas.
c: Identify and use appropriate style and vocabulary for a particular audience.
726.03: Write to inform and explain.
   a: Use facts, data, and processes from technical and non-technical materials to inform through writing.
   b: Produce documents in appropriate format to inform and explain.

726.06: Write to gather, synthesize, and communicate research findings.
   a: With teacher support, incorporate a variety of technological and informational resources to do the following:
      • Appropriately paraphrase, quote, and cite to avoid plagiarism.
      • Formulate thesis or focus and relevant support.
      • Formulate and support main idea with evidence.
   b: Present research findings.

727.01: Listen for information and understanding.
   a: Acquire and summarize information from a variety of electronic or live sources.
   c: Develop use of effective interpersonal listening skills.

728.01: Speak to share an understanding of information.
   a: Use age-appropriate oral communication for various purposes and audiences that appropriately incorporates the following:
      • a variety of word choices;
      • pronunciation;
      • inflection/modulation;
      • physical gestures;
      • eye contact;
      • posture.
   b: Plan and deliver oral presentations that incorporate the following:
      • transitions;
      • organizations;
      • support of main ideas;
      • examples;
      • response to questions and feedback;
      • visual aids and appropriate technology.

729.01: View for information and understanding.
   a: Use traditional and visually-presented materials (books, films, videos, Internet).
   b: Use viewing skills to determine main idea and collect data.
729.04: **Use a variety of resources to produce visuals that communicate through print and non-print media.**  
   a: Demonstrate understanding of graphics, pictures, color, motion, and music.  
   b: With support, apply technical skills to produce effective visuals.

**HUMANITIES**

940.01: **Understand concepts essential to visual and performing arts.**  
   b2: Use different media, techniques, and processes to communicate an idea or to tell a story.

**Suggested Activities:**

1. Make a walk-through model of the human digestive system and invite younger children to tour.  
2. Watch the *Magic Schoolbus* video on the Digestive System, the Immune System, Muscles and Bones, etc.  
3. Use the AIMS Human Body unit, the book, *Blood and Guts*, or any number of books available to supplement this section.  
4. Do the “Circulatory System” relay. Make flashcards to label the parts of the heart, lung, and big toe. Students move through the correct path of the circulatory system, get an oxygen card and progress through to the big toe. Then speed up to keep the body alive.  
5. Divide the students into groups to prepare a PowerPoint presentation on an assigned body system. Or use a variety of presentation styles – game show, news report, interview, play, puppet show, etc.  
6. Make a human body travel brochure. Include pertinent vocabulary for life sciences: function, growth, structure, survival, characteristics, etc.  
7. Watch sections of the movie “Fantastic Voyage” and/or “Inner space”.

**Suggested Assessment:**

1. Role-play – Role-play in teams of 2 or 3 for oral presentation. Evaluate via a pre-determined, pre-distributed rubric. Sample rubrics are available at www.rubrics.com. Students take notes on other groups’ presentations. Follow up with a short quiz on each system.  
2. Model – “Dress” a blank body by attaching organs/systems. Briefly tell the teacher the function of each system.
Concept #4: Heredity.

Objective
1. Know that traits are passed from parent to offspring.

Idaho Achievement Standards

SCIENCE
621.01: Understand the cell is the basis of form and function for all living things and how living things carry out their life functions.
   c: Explore the concept that traits are passed from parents to offspring.
618.03: Understand constancy, change, and measurement.
   a: Recognize that some concepts in science do not change with time.
   b: Analyze changes that occur in and among systems.
618.05: Understand concepts of form and function.
   a: Understand that the shape or form of an object or system is frequently related to its use or function.
627.01: Understand the significance of major scientific milestones.
   a: Understand major contributions of various scientists and researchers.
628.01: Understand that interpersonal relationships are important in scientific endeavors.
   a: Work in teams to solve problems.

HEALTH
823.01: Acquire the essential skills to lead a healthy life.
   e: Identify the choices and consequences related to abuse of alcohol, tobacco, and other drugs.
824.01: Demonstrate the ability to practice health-enhancing behaviors and reduce health risks.
   a: Identify risk factors for illness and injuries.
   b: Examine and evaluate how the actions of one person affect the behaviors of others.
   c: Describe high-risk substance abuse situations and behaviors that pose a risk to one’s self and others.
d: Describe the impact of risky behaviors on personal and family health.

LANGUAGE ARTS

725.01: Read a variety of traditional and electronic materials for information and understanding.

b: Search purposefully for particular information:
   • Identify literal and inferential meanings.
   • Search own background information to make meaning of text passages.
   • Based on purpose of reading, search for most important information.
   • In order to understand plot development in narratives, search for information about characters and setting.
   • In order to understand text, search for such expository text structures as cause/effect, chronological, problem/solution, classification.

Suggested Activities:

1. Make a Punnett Square – developed using Mendel’s work– to show how dominant and recessive traits interact.
2. Make a chart to show inherited traits based on family interviews.
3. Do a Web quest about genetics.
4. Show parts of the movie “GATTACA” to show genetic engineering.
5. Read Madeline l’Engle’s, Wind in the Door.
6. Rebopps, Bug Builders, Make a Baby, etc. activities found on the web.

Suggested Assessment:

1. Complete a Punnett square and explain in a paragraph or orally.
2. Teacher can use a checklist of standard objectives for assessment.

Suggested Resources:

Holt Life Science book
Biology With Junk
Dr. Lawrence Lowery – Lawrence Hall of Science at Berkeley, California – “A Biological Basis of Learning”
Blood and Guts; Little, Brown – body systems
Instructional Theme #2: Earth and Space

Goal statement: Understand the interactions among Earth, oceans, organisms, and atmosphere and the impact on the environment.

Concepts:

1. Water Cycle
2. Atmosphere
3. Organism
4. Oceans
5. Environmental Impact
6. Solid Earth
Earth and Space

- Concept #1: Water Cycle
- Concept #2: Atmosphere
- Concept #3: Plate Tectonics
- Concept #4: Oceans
- Concept #5: Environmental Impact
- Concept #6: Solid Earth
Concept #1: Water Cycle

Objectives
1. Know the phases and properties of water.
2. Explain the factors that influence the water cycle: temperature, altitude, relative humidity, etc.
3. Explain the water cycle.
4. Interpret the relationships between regional climate and the water cycle.

Idaho Achievement Standards

SCIENCE
618.01: Understand systems, order, and organization.
   a: Know that a system is an organized group of related objects that form a whole.
618.02: Understand concepts and processes of evidence, models, and explanation.
   c: Use models to explain or demonstrate a concept.
618.03: Understand constancy, change, and measurement.
   a: Recognize that some concepts in science do not change with time.
   b: Analyze changes that occur in and among systems.
618.04: Understand the theory that evolution is a process that relates to the gradual changes in the universe and of equilibrium as a physical state.
   a: Understand the relationships of past, present, and future.
620.01: Understand the structure and function of matter and molecules and their interactions.
   b: Explore and calculate properties of matter.
624.01: Understand scientific theories of origin and subsequent changes in the universe and earth systems.
   b: Know the water cycle and its relationship to weather and climate.
626.03: Understand the importance of natural resources and the need to manage and conserve them.
   a: Understand the differences between renewable and nonrenewable resources.
   b: Understand the conservation of natural resources.
LANGUAGE ARTS

726.06: Write to gather, synthesize, and communicate research findings.

a: With teacher support, incorporate a variety of technological and informational resources to do the following:
   • Appropriately paraphrase, quote, and cite to avoid plagiarism.
   • Formulate thesis or focus and relevant support.
   • Formulate and support main idea with evidence.

Suggested Activities:

1. Do a bottle biology project (terrarium).
2. Draw and label a diagram of the water cycle.
3. Show or read the Magic Schoolbus Water Cycle book and/or video.
4. Outline a puddle with chalk and then at regular time intervals observe and graph the change.
5. Project Wet activities: “Incredible Journey”
7. Water Awareness Week activities: “Let It Rain”, “Our Water Supply is Limited”
8. Fresh water distilled from salt water.
9. Voyage of the Mimi I from the 13-video set. (Desalination)
10. Calculate densities of ice, hot water and cold water. (Ice cube – calculate volume by displacement and mass by scale; water - calculate mass by converting volume to mass using 1cm³ = 1 ml = 1 g)

Suggested Assessment:

1. Model – Draw and label the water cycle.
2. Write a story from the viewpoint of a drop of water.
3. Do a PowerPoint presentation that compares and contrasts three climate regions and temperature, altitude, and humidity. Interpret the relationship among the three factors that influence climate.
4. Make a comic book or storyboard that explains the water cycle to next year’s class.
Instructional Theme #2: Earth and Space

Concept #2: Atmosphere

Objectives
1. Identify cloud types.
2. Associate the water cycle with cloud formation.
3. Understand the components of weather and climate.
4. Sequence the development of weather technology.
5. Interpret data found on a weather map.
6. Create a tool to collect weather data.

Idaho Achievement Standards

SCIENCE

618.02: Understand concepts and processes of evidence, models, and explanation.
   a: Know that observations and data are evidence on which to base scientific explanations and predictions.
   b: Know the difference between observations and inferences.
   c: Use models to explain or demonstrate a concept.

618.03: Understand constancy, change, and measurement.
   b: Analyze changes that occur in and among systems.
   c: Measure using standard and metric systems with an emphasis on the metric system.

618.04: Understand the theory that evolution is a process that relates to the gradual changes in the universe and of equilibrium as a physical state.
   a: Understand the relationships of past, present, and future.

619.01: Understand scientific inquiry and develop critical thinking skills.
   c: Select and use appropriate tools and techniques to gather and display data.
   d: Analyze data in order to develop descriptions, explanations, predictions, and models using evidence.
   g: Communicate scientific procedures and explanations.
624.01: Understand scientific theories of origin and subsequent changes in the universe and earth systems.
   a: Investigate the interactions between the solid earth, oceans, atmosphere, and organisms.
   c: Identify cumulus, cirrus, and stratus clouds and their relationship to weather changes.

625.01: Understand the relationship between science and technology and develop the abilities of technological design and application.
   a: Know that science and technology are human endeavors interrelated to each other, to society, and to the work place.
   b: Compare scientific inquiry and technological design in terms of activities, results, and influences on individuals and society; know that science enables technology and vice versa.
   d: Use available and appropriate technology.

626.04: Understand different uses of technology in science and how they affect our standard of living.
   a: Identify examples of technologies used in these scientific fields:
      • food production;
      • environmental cleanup;
      • advances in medicine;
      • communications;
      • the space program;
      • weather forecasting.

627.01: Understand the significance of major scientific milestones.
   a: Understand major contributions of various scientists and researchers.

628.01: Understand that interpersonal relationships are important in scientific endeavors.
   a: Work in teams to solve problems.

628.02: Understand technical communication.
   a: Read, understand, and follow technical instructions.
   b: Write a lab report.
MATHEMATICS
319.01: Understand and use U.S. customary and metric measurements.
   a: Select and use appropriate units and tools to make formal measurements in both systems.
   b: Apply estimation of measurement to real-world and content problems using actual measuring devices.
   c: Recognize the differences and relationships between perimeter and area in both systems.
   d: Solve problems involving length, perimeter, area, weight, mass, and temperature.
   e: Convert unit of measurement within each system.
   f: Apply understanding of relationships to solve real-world problems related to time.
   g: Use appropriate vocabulary.

LANGUAGE ARTS
726.01: Understand and use the writing process.
   b: Write in a variety of formats to record, generate, and reflect upon ideas.

Suggested Activities:
1. Contact your local weather reporter from the television station. Inquire about a speaker/presenter, weather collection materials, etc.
2. Use weather maps from the newspapers to practice reading information.
3. Use the Internet to access NASA, Jason, NOAA, weather sites, etc., for weather information from around the world.
4. Locate information on GLOBE from your local university.
7. Build a weather station including a rain gauge, barometer, anemometer, wind sock, etc. (Lesson plans are available on the web by searching for weather activities.)
8. Use The Farmer’s Almanac to research weather patterns over time.
9. Record your local minimum and maximum temperatures for a week and graph the data.
10. Research technology – past and present – for weather data collection on the Internet or in your library.


Suggested Assessment:

1. Correctly label cloud types on a worksheet.

2. Create a board game that integrates cloud formation, weather and climatic conditions, and characteristics of clouds in groups. Each student must write out the objective of the game. Score using a pre-discussed and pre-distributed rubric.

3. Utilize four or five websites to prepare a presentation of students’ 10 – 12 favorite facts about clouds and weather patterns.

4. Provide pictures of weather data collection tools. Have students sequence the tools chronologically.

5. Give each student a weather map. Have each student prepare the weather prediction presentation in a newspaper, television, or radio format.

6. Judge the tool created for weather data collection based on a pre-discussed and pre-distributed rubric.
Instructional Theme #2: Earth and Space

Concept #3: Plate Tectonics

Objectives
1. Review the concept of Pangaea (Super Continent).
2. Explain plate tectonics and continental drift.
3. Relate volcanic activity to atmospheric conditions.
4. Research technology in data collection (GPS, satellites, seismographs).

Idaho Achievement Standards

SCIENCE

618.02: Understand concepts and processes of evidence, models, and explanation.
   d: Develop skills to create scientific explanations based on scientific knowledge, logic, and analysis.

620.01: Understand the structure and function of matter and molecules and their interactions.
   d: Understand the nature of physical change and how it relates to physical properties.

624.01: Understand scientific theories of origin and subsequent changes in the universe and earth systems.
   a: Investigate the interactions between the solid earth, oceans, atmosphere, and organisms.

626.04: Understand different uses of technology in science and how they affect our standard of living.
   a: Identify examples of technologies used in these scientific fields:
      • food production;
      • environmental cleanup;
      • advances in medicine;
      • communications;
      • the space program;
      • weather forecasting.

627.01: Understand the significance of major scientific milestones.
   a: Understand major contributions of various scientists and researchers.
LANGUAGE ARTS

729.01: View for information and understanding.
   a: Use traditional and visually-presented materials (books, films, videos, Internet).
   b: Use viewing skills to determine main idea and collect data.

726.01: Understand and use the writing process.
   b: Write in a variety of formats to record, generate, and reflect upon ideas.

727.01: Listen for information and understanding.
   a: Acquire and summarize information from a variety of electronic or live sources.

Suggested Activities:

1. See 5th grade earth science curriculum as reference for background.
2. Build a seismograph with a lesson plan from the Internet.
3. Do the plate tectonics jigsaw puzzle activity from the Jason XIV available on the website.
4. Watch a video on earthquakes and/or volcanoes.
5. Copy and cut out the continents from a world map and try to assemble a super continent.
6. Research plate tectonics and do a PowerPoint presentation.
7. Learn about the effects of volcanic outgases and debris on weather patterns from the Mount St. Helen’s eruption in 1980.
8. Read or watch the Magic School Bus book/video on volcanoes.
9. Invite a speaker from USGS (US Geological Survey), Greenpeace, US Forest Service, DEQ (Dept. of Environmental Quality), DNR (Department of Natural Resources), etc.
   - How Close is Safe? Buffer Zone Development
   - Sensing Volcanic Effects from Space
   - Tracking World Aerosol Hazards
11. Contact Julie Scanlin with Project WET at jscanlin@uidaho.edu for information on geothermal energy (GEO Great Earth Odyssey).
12. Write a fable to explain the theory of plate tectonics as it relates to changes in the surface of the earth. Act it out for the class.
Suggested Assessment:

1. Create a comic strip or storyboard showing the progression from Pangaea to the current location of continents incorporating continental drift and plate tectonics. Show activity along the intersection of plates.

2. Write a story about climatic changes in New York due to a volcanic eruption on the Pacific or a continent away.

3. Make a list of the tools you would use to learn about the solid earth. Or create a matching game to show the tools used in the study of the earth and their purposes. Include GPS, seismographs, etc.
Concept #4: Oceans

Objectives
1. Recognize the relationship between ocean currents and air currents.
2. Research the progression of ocean data gathering techniques.
3. Report on the explorers who have made contributions to our understanding of the ocean.

Idaho Achievement Standards

SCIENCE

624.01: Understand scientific theories of origin and subsequent changes in the universe and earth systems.
   a: Investigate the interactions between the solid earth, oceans, atmosphere, and organisms.

626.04: Understand different uses of technology in science and how they affect our standard of living.
   a: Identify examples of technologies used in these scientific fields:
      • food production;
      • environmental cleanup;
      • advances in medicine;
      • communications;
      • the space program;
      • weather forecasting.

627.01: Understand the significance of major scientific milestones.
   a: Understand major contributions of various scientists and researchers.

LANGUAGE ARTS

725.01: Read a variety of traditional and electronic materials for information and understanding.
   a: Use decoding strategies and other visual information to fluently read and construct meaning from grade-level text:
      • graphophonic sources (letter/sound);
      • semantic sources (meaning/associations);
      • lexical sources (word knowledge);
      • syntactic sources (structure of written language);
b: Search purposefully for particular information:
   • Identify literal and inferential meanings.
   • Search own background information to make meaning of text passages.
   • Based on purpose for reading, search for most important information.
   • In order to understand plot development in narratives, search for information about characters and setting.
   • In order to understand text, search for such expository text structures as cause/effect, chronological, problem/solution, classification.

726.03: Write to inform and explain.
   a: Use facts, data, and processes from technical and non-technical materials to inform through writing.
   b: Produce documents in appropriate format to inform and explain.

Suggested Activities:

1. Find a convection activity from a book or on the Internet to show convection currents. (These are readily available.)
2. Videotape several days’ worth of satellite weather data from the local news. Observe the effects of ocean currents on your weather patterns.
3. Research habitats for penguins to see how ocean currents influence their locations.
4. Read Jason and the Argonauts; follow with the SS Titanic story to understand the historical development of ocean exploration.
5. Make ocean explorer baseball cards and/or a matching game using tools and functions for ocean data collection.
6. Read The Voyage of the Frog, Troubling a Star, 20,000 Leagues Under the Sea, or some other stories involving ocean exploration.
7. Watch the National Geographic video on Bob Ballard’s exploration of the Titanic.
8. Project WET “Common Water”.

Earth and Space 26
Suggested Assessment:

1. Use a table showing daily temperatures for two weeks in Honolulu, Hawaii, and Mexico City, Mexico. Have students compare and contrast the two locations and provide possible explanations for the temperature differences.

2. Provide transparencies of ocean currents and air currents for students to superimpose. Write a paragraph to explain the effect on climate on a given region. The teacher could choose a variety of locations to give to various groups of students.

3. Make a timeline of ocean data-gathering technology. Link it to the explorers who used the technology in their time.
Concept #5: Environmental Impact

Objective
1. Investigate the interaction between organisms and earth systems.

Idaho Achievement Standards

SCIENCE

624.01: Understand scientific theories of origin and subsequent changes in the universe and earth systems.
   a: Investigate the interactions between the solid earth, oceans, atmosphere, and organisms.

618.05: Understand concepts of form and function.
   a: Understand that the shape or form of an object or system is frequently related to its use or function.

625.01: Understand the relationship between science and technology and develop the abilities of technological design and application.
   b: Compare scientific inquiry and technological design in terms of activities, results, and influences on individuals and society; know that science enables technology and vice versa.

626.03: Understand the importance of natural resources and the need to manage and conserve them.
   a: Understand the differences between renewable and nonrenewable resources.
   b: Understand the conservation of natural resources.

Suggested Activities:

1. Research habitats for penguins to see how ocean currents influence their locations.
2. Make a model of a “black smoker” and list the adaptations it had to make to live in that environment.
3. Compare and contrast one animal that dwells in the ocean depths to an animal that lives near shore.
4. Investigate an organism in your area that has been impacted by an earth system change.
5. Jason XIV: “Pinniped Adaptations”
Suggested Assessment:

1. Do a research paper on penguin habitats (or some other animal/habitat). Provide a rubric that includes the interdependence of ocean, atmosphere, and solid earth. Or use the rubric to evaluate the model created in the “black smoker” activity.
Instructional Theme #2: Earth and Space

Concept #6: Solid Earth

Objective
1. Investigate impact of human activities on earth systems (solid earth, oceans, atmosphere) and their
   short term and long-term results.

Idaho Achievement Standards

SCIENCE

618.01: Understand systems, order, and organization.
   a: Know that a system is an organized group of related objects that form a whole.

618.02: Understand concepts and processes of evidence, models, and explanation.
   b: Know the difference between observations and inferences.

618.03: Understand constancy, change, and measurement.
   b: Analyze changes that occur in and among systems.

618.04: Understand the theory that evolution is a process that relates to the gradual changes in the
   universe and of equilibrium as a physical state.
   a: Understand the relationships of past, present, and future.

619.01: Understand scientific inquiry and develop critical thinking skills.
   a: Develop questions that can be answered by conducting scientific experiments.
   b: Conduct scientific investigations using controls and variables when appropriate.
   c: Select and use appropriate tools and techniques to gather and display data.

624.01: Understand scientific theories of origin and subsequent changes in the universe and earth
   systems.
   a: Investigate the interactions between the solid earth, oceans, atmosphere, and organisms.

626.01: Understand common environmental quality issues, both natural and human induced.
   a: Identify issues for environmental studies.

626.02: Understand the causes and effects of population change.
   a: Understand the effect of technological development and human population growth on the
      United States and/or the world.

626.03: Understand the importance of natural resources and the need to manage and conserve
   them.
   a: Understand the differences between renewable and nonrenewable resources.
   b: Understand the conservation of natural resources.
HEALTH

823.01: Acquire the essential skills to lead a healthy life.
   a: Identify the influence exercise has in developing a healthy system.
   b: Identify prevention, causes, and treatment of diseases and disorders.

SOCIAL STUDIES

469.01: Understand the spatial organizations of people, places, and environment on the earth’s surface.
   f: Explain patterns of land use in urban, suburban, and rural areas.
   g: Explain ways places are connected and interdependent.

469.05: Understand that human actions modify the physical environment and how physical systems affect human activity and living conditions.
   a: Analyze the consequences of human changes to the physical environment.
   b: Explain ways in which human-caused changes in the environment in one place can cause changes in other places.
   c: Identify and analyze the role of technology in changing the physical environment.
   f: Analyze world patterns of resource distribution and use.

LANGUAGE ARTS

725.01: Read a variety of traditional and electronic materials for information and understanding.
   b: Search purposefully for particular information:
      • Identify literal and inferential meanings.
      • Search own background information to make meaning of text passages.
      • Based on purpose for reading, search for most important information.
      • In order to understand plot development in narratives, search for information about characters and setting.
      • In order to understand text, search for such expository text structures as cause/effect, chronological, problem/solution, classification.
   d: Monitor and adjust a response based upon more than one source of information from grade-level text.
   f: Draw inferences and conclusions from text.
   h: Determine main idea or essential message within a text and identify relevant details and facts.
725.03: Read a variety of traditional, technical, and electronic materials from critical analysis and evaluation.

a: Identify author’s purpose and describe how language, setting, and information support purpose within literary text.

b: Analyze literary text for following story elements:
   - characters;
   - setting;
   - point of view;
   - plot structure;
   - theme.
   - conflict;
   - resolution.

c: Compare and contrast information from multiple sources.

d: Use personal or objective criteria to do the following:
   - draw conclusions;
   - make inferences;
   - determine meanings;
   - form opinions;
   - make judgments.

e: Distinguish between fact and opinion and identify cause and effect relationships within expository text.

725.04: Read to locate information from a variety of traditional, technical, and electronic sources.

a: Use questions to guide reading:
   - Identify type of information required to answer a specific question.
   - Use reasonable resources for answering questions.
   - Read for purpose of answering specific questions.

b: Systematically organize new information from expository text.

c: Synthesize what has been read:
   - Identify main idea and supporting details.
   - Identify important information, patterns, and themes.
   - Connect new information with prior knowledge to enhance understanding and memory.
   - Ask new questions.
   - Use prior knowledge and text information to draw conclusions, make critical judgments, and form unique interpretations from text.

725.05: Read for technical information.

a: Read, understand, and apply technical information.

b: Identify and use comprehension strategies to understand technical text.

e: Apply technical information to complete tasks.
726.01: Understand and use the writing process.
   a: Understand and apply steps of the writing process:
      • brainstorm;
      • draft;
      • revise;
      • edit/proofread;
      • publish.
   b: Write in a variety of formats to record, generate, and reflect upon ideas.

726.02: Write and edit for correctness and clarity.
   a: Determine and apply rules and conventions for the following:
      • grammar;
      • punctuation;
      • capitalization;
      • spelling;
      • legibility.

726.03: Write to inform and explain.
   a: Use facts, data, and processes from technical and non-technical materials to inform through writing.
   b: Produce documents in appropriate format to inform and explain.

726.04: Write for literary response and expression.
   b: Appropriately use a thesis and supporting evidence.

726.05: Write to critically analyze and evaluate.
   b: Use a thesis/main idea and appropriate supporting evidence to persuade and inform a specific audience.

726.06: Write to gather, synthesize, and communicate research findings.
   b: Present research findings.

727.01: Listen for information and understanding.
   a: Acquire and summarize information from a variety of electronic or live sources.

728.03: Speak for critical analysis and evaluation.
   a: Clearly express opinions and judgments.
   b: Encourage others’ participation while exhibiting courteous, attentive, and appropriate behavior during discussions.
729.01: View for information and understanding.
   a: Use traditional and visually-presented materials (books, films, videos, Internet).

729.03: View media to engage in critical analysis and evaluation.
   b: Critique, interpret, and evaluate non-print media.

729.04: Use a variety of resources to produce visuals that communicate through print and non-print media.
   b: With support, apply technical skills to produce effective visuals.

HUMANITIES

940.01: Understand concepts essential to visual and performing arts.
   b2: Use different media, techniques, and processes to communicate an idea or story.

Suggested Activities:

2. Project WILD activities: “Classroom Carrying Capacity”, “To Zone or Not to Zone”, “Hazardous Links” or “Deadly Links”, “Litter We Know”
4. Learn about global warming, acid rain, ozone depletion, oceanic pollution, endangered species, breaching dams and/or wolf or grizzly re-introduction, and debate the issues from various points of view – recreation, commercial development, agriculture, environmental, concerned citizen, etc. Some students could write for different purposes: to inform, to persuade, to explain, to entertain, etc. These could be presented orally, on video, or as a play. Write a thesis on your findings and your opinion.
5. Tie into social studies investigation of the geography of rainforests in Latin America.
6. Read Julie Craighead George’s A Day in the Tropical Rainforest.
7. Discuss the global impact of U.S. consumption and the export of our lifestyle worldwide.
8. In small groups, collect 20 facts about the Titanic. As a large group, categorize the facts and compare the data; discuss reliability of the sources.
9. Read Rachel Carson’s *Silent Spring*, the origins of the environmental movement, Madeline l’Engle’s *Troubling a Star*, Dr. Seuss’ *The Lorax*, Chris Van Alsburg’s *Just a Dream*, Jean Craighead George’s books like *What Ever Happened to Cock Robin?* or *The Case of the Missing Cutthroats*, Ben Mikaelson’s *Stranded*, *Rescue Josh McGuire*, *Countdown*, or others that deal with environmental issues.


12. NASA Student Involvement Program – Watching Earth Change Research Project (The Earth shows different faces and tells different stories when observed from high above through different instruments.)

**Suggested Assessment:**

1. Create a conservation plan for your household. Include your use of water, electricity, and waste management. Make a table showing current consumption and consumption after effecting the plan.

2. Choose an Idaho issue: breaching of dams, plutonium in the aquifer, wolf introduction, forestry, water pollution and/or conservation. Write a letter to the editor or the Governor explaining the impact of the proposed plan and offer your solution to the problem.

3. Take a walk with an expert on environmental issues. Have the students explain or demonstrate to the expert their knowledge of the problem and the possible solution. Provide a rubric for the expert to evaluate the students’ knowledge.

4. Have an environmental science fair. Students must show their use of the scientific method in their project. Encourage children to create an invention that would solve an environmental problem, i.e., a salmon-friendly dam, a safe deterrent for a noxious weed, etc.

**Suggested Resources:**

Jason Project Activities
FOSS Water Kit
STC Ecosystems kit
Project WILD
Project WET
Project WILD Aquatics
Project Learning Tree
Water Awareness Week information and activities
GLOBE activities
Department of Environmental Quality
Local water and waste water treatment facilities
Local weather service or weather forecasters from television
Internet sites requesting lesson plans on specific topics
Farmer’s Almanac
The county agent and/or the Cooperative Extension office in your county
For information regarding attending a Jason workshop, contact Cheryl Burgess at cburgess@inel.gov or Jeff Benson at bensj@inel.gov
NASA activities: “The Atmosphere Below” video and lessons – changes in Earth’s atmosphere are investigated from outer space onboard the space shuttle. This is available from U of I Educator Resource Center @ 208.885.7536 or NASA Ames ERC @ //core.nasa.gov
Instructional Theme #3: Physical Science

Goal statement:
Understand the relationship among forces, motion, and energy as they relate to physical objects.

Concepts:
1. Forms of Energy
2. Forces
3. Newton’s Laws
4. Technology Design
Physical Science

Concept #1: Forms of Energy

Concept #2: Forces

Concept #3: Newton’s Laws

Concept #4: Technology Design

Motion and Energy
Concept #1: Forms of Energy

Objectives
1. Identify examples of thermal (heat), radiant (solar), and nuclear energy.
2. Identify types of energy—potential and kinetic.

Idaho Achievement Standards

SCIENCE
620.03: Understand concepts of motion and forces.
   b: Investigate different forms of energy.

SOCIAL STUDIES
469.02: Understand the human and physical characteristics of places and regions.
   f: Understand the effects of technology on cultural groups’ perceptions of places and regions.
469.05: Understand that human actions modify the physical environment and how physical systems affect human activity and living conditions.
   c: Identify and analyze the role of technology in changing the physical environment.
   f: Analyze world patterns of resource distribution and use.
   g: Identify the role of technology in acquiring resources.

LANGUAGE ARTS
729.01: View for information and understanding.
   a: Use traditional and visually-presented materials (books, films, videos, Internet).
   b: Use viewing skills to determine main idea and collect data.
726.01: Understand and use the writing process.
   b: Understand and apply steps of the writing process:
      • brainstorm;
      • draft;
      • revise;
      • edit/proofread;
      • publish.
**Suggested Activities:**

1. Do a PowerPoint presentation or a collage showing different examples of energy.
2. Use a yo-yo to demonstrate kinetic and potential energy, or use button spinners.
3. Use the *Magic Schoolbus* video and/or book on energy.
4. Keep an energy journal for a day – food they eat, fuels, heat, light, etc.
5. Use the AIMS activity, *When I Was Ten*. Interview someone born before 1920 about life when he/she was 10 years old. Compare lifestyle with the student’s life at 10 years old. Make a Venn diagram to compare and contrast their lives. Write a paragraph or a table to reflect the comparison.
6. Look at regional resources that are attractive to industry. What industries would be attracted to your region based on the energy resources available?
7. Compare energy consumption between the U.S. and a third world country.

**Suggested Assessment:**

1. Match examples of energy sources with their correct types (radiant, thermal, and nuclear); i.e., Lava Springs, American Falls dam, solar panels on homes, INEEL, calculator, etc. Or give an example of how each type can be used through writing, drawing, or a collection of photos or magazine pictures.
2. List examples or collect objects that show kinetic or potential energy.
Instructional Theme #3: Physical Science

Concept #2: Forces

Objectives
1. Know the effect of gravity on all objects.
2. Know the effect of friction on all objects.
3. Explore inertia.
4. Explore the difference between mass and weight.

Idaho Achievement Standards

SCIENCE

618.02: Understand concepts and processes of evidence, models, and explanation.
   a: Know that observations and data are evidence on which to base scientific explanations and predictions.
   d: Develop skills to create scientific explanations based on scientific knowledge, logic, and analysis.

618.03: Understand constancy, change, and measurement.
   a: Recognize that some concepts in science do not change with time.
   c: Measure using standard and metric systems with an emphasis on the metric system.

619.01: Understand scientific inquiry and develop critical thinking skills.
   a: Develop questions that can be answered by conducting scientific experiments.
   b: Conduct scientific investigations using controls and variables when appropriate.
   c: Select and use appropriate tools and techniques to gather and display data.
   d: Analyze data in order to develop descriptions, explanations, predictions, and models using evidence.
   e: Develop a hypothesis based on observations.
   f: Compare alternative explanations and predictions.
   g: Communicate scientific procedures and explanations.

620.03: Understand concepts of motion and forces.
   a: Observe the effects of different forces (gravity and friction) on the movement, speed, and direction of an object.
625.01: Understand the relationship between science and technology and develop the abilities of technological design and application.
   d: Use available and appropriate technology.

627.01: Understand the significance of major scientific milestones.
   a: Understand major contributions of various scientists and researchers.

628.01: Understand that interpersonal relationships are important in scientific endeavors.
   a: Work in teams to solve problems.

628.02: Understand technical communication.
   a: Read, understand, and follow technical instructions.
   b: Write a lab report.

MATHEMATICS

317.01: Understand and use numbers.
   c: Expand the use of decimals and fractions to explore the use of percent and ratios.

317.03: Estimate and judge reasonableness of results.
   a: Use estimation to predict computation results.

318.01: Understand and use a variety of problem-solving skills.
   a: Use a variety of strategies to compare problems drawn from real-world situations.
   b: Solve problems using the 4-step process of problem solving (explore, plan, solve, examine).
   c: Make predictions and decisions based on information.

318.02: Use reasoning skills to recognize problems and express them mathematically.
   a: Use a variety of methods such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning and concepts.
   b: Apply solutions and strategies to new problem situations.

318.03: Apply appropriate technology and models to find solutions to problems.
   a: Understand the purpose and capabilities of appropriate technology used as a tool to solve problems.
   b: Use computer applications to display and manipulate data.

318.04: Communicate results using appropriate terminology and methods.
   a: Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models to communicate mathematical information.
   b: Use appropriate vocabulary to communicate mathematical information.
319.01: **Understand and use U.S. customary and metric measurements.**
   a: Select and use appropriate units and tools to make formal measurement in both systems.
   b: Apply estimation of measurement to real-world and content problems using actual measuring devices.
   d: Solve problems involving length, perimeter, area, weight, mass, and temperature.
   g: Use appropriate vocabulary.

319.02: **Apply concepts of rates and other derived or indirect measurements.**
   a: Explore the use of rates to make indirect measurements.

319.03: **Apply the concepts of ratios and proportions.**
   a: Explore the use of proportions, ratios, and scales.

322.02: **Collect, organize, and display data.**
   a: Collect, organize, and display data with appropriate notation in tables, charts, and graphs (line graphs, bar graphs, frequency lines or line plots, and circle graphs).

**LANGUAGE ARTS**

725.01: **Read a variety for traditional and electronic materials for information and understanding.**
   b: Search purposefully for particular information:
      • Identify literal and inferential meanings.
      • Search own background information to make meaning of text passages.
      • Based on purpose for reading, search for most important information.
      • In order to understand plot development in narratives, search for information about characters and setting.
      • In order to understand text, search for such expository text structures as cause/effect, chronological, problem/solution, classification.

729.01: **View for information and understanding.**
   a: Use traditional and visually-presented materials (books, films, videos, Internet).
   b: Use viewing skills to determine main idea and collect data.

**Suggested Activities:**

1. Get a very tall ladder and a 2”x4” board. Place two objects on the board and tip the board so that both objects drop. Choose similar objects like a whiffle ball and a toy ball. Discuss air resistance as a reason for the difference in the rate of drop rather than gravity.
2. Design and make balloon powered cars using balloons, index cards, skewers, juice or milk lids. Race the cars on carpeted floors versus tile floors. Try outdoors on blacktop, sand, or gravel. Describe the entire process in your science notebook. Be sure to use a table, state the problem, and describe the process you used. Include drawings and diagrams. Use class results to input data and create a graph on the computer. Predict results of changing a variable based on this data.

3. Show the *Magic Schoolbus* video on gravity and friction.

4. Set up and inquiry-based activity using an inclined slope or plane and various sizes of cans. Emphasize the scientific method concerning hypotheses and controlled variables.

5. Use a spring scale to determine the amount of force necessary to lift or pull a variety of objects – cans, a book, etc.

6. Crumple a piece of paper and keep one flat. Drop at the same time and discuss surface area as it relates to rate of drop.

7. Put a yardstick on a table. Hit the end of the yardstick and watch it flip. Then open a single sheet of newspaper and lay it over half of the yardstick. Then hit the end again and watch the yardstick break.

8. Research your weight and mass on all of the planets of the solar system. Observe that mass doesn’t change. Weight depends on gravity.

9. Bring a skateboard to school. Have the student hang on to one end of the spring scale and pull them on different types of surfaces – carpet, grass, pavement, concrete, tile, etc. Compare the results to see the effects of friction.

10. Repeat Galileo’s experiment with the feather and the rock. Climb to the top of the highest available structure. Drop both and observe results.

**Suggested Assessment:**

1. Design an experiment to reduce friction on your design for the balloon-powered car, or design a Rube Goldberg machine that incorporates the use of friction, gravity, and inertia.
Concept #3: Newton’s Laws

Objectives
1. Explain, in simple language, all 3 of Newton’s Laws.
2. Identify examples of Newton’s Laws in the world around you.
3. Identify the steps in the scientific method from hypothesis to law.

Idaho Achievement Standards

SCIENCE

618.02: Understand concepts and processes of evidence, models, and explanation.
   a: Know that observations and data are evidence on which to base scientific explanations and predictions.
   b: Know the difference between observations and inferences.
   c: Use models to explain or demonstrate a concept.
   d: Develop skills to create scientific explanations based on scientific knowledge, logic, and analysis.

618.03: Understand constancy, change, and measurement.
   a: Recognize that some concepts in science do not change with time.
   c: Measure using standard and metric systems with an emphasis on the metric system.

619.01: Understand scientific inquiry and develop critical thinking skills.
   a: Develop questions that can be answered by conducting scientific experiments.
   b: Conduct scientific investigations using controls and variables when appropriate.
   c: Select and use appropriate tools and techniques to gather and display data.
   d: Analyze data in order to develop descriptions, explanations, predictions, and models using evidence.
   e: Develop a hypothesis based on observations.
   f: Compare alternative explanations and predictions.
   g: Communicate scientific procedures and explanations.

620.03: Understand concepts of motion and forces.
   a: Observe the effects of different forces (gravity and friction) on the movement, speed, and direction of an object.
   b: Investigate different forms of energy.
627.01: Understand the significance of major scientific milestones.
   a: Understand major contributions of various scientists and researchers.

Suggested Activities:

1. Thread a length of fishing line or fine wire through a plastic drinking straw. Stretch the piece of fishing line or wire from one side of the classroom to the other and secure its ends. Blow up a long balloon and, while pinching the balloon closed with your fingers, attach it to the straw using masking tape. Release the balloon and watch it travel down the length of line or wire. Experiment to identify the factors involved for the balloon to achieve maximum distance.

2. Make water rockets. The directions are available on the Internet.

3. Do the NASA Rockets unit EG-1999-06-108-HQ


5. Check out the Physics of Car Crashes from the State of Idaho Library.

6. For Newton’s Law #1: Place a straight sided glass on a flat surface. Position a playing card so that it bridges across the open mouth of the glass. Set a coin in the middle of the card. Quickly flick the card with your finger. The card should fly off of the glass as the coin falls into the glass.

7. For Newton’s Law #2: Get a bathroom scale – preferably with a digital readout. Duct tape the scale to the back of a rolling chair or cart. Select two students with different masses to sit on the cart/chair. Apply equal force to the scale to move the cart/chair with each student in turn. The amount of force used to push student A has to equal the amount to move student B. Measure the distance that each student can be moved using the same amount of force. Have students use the data gathered to determine the formula. (Force = mass x acceleration).

8. For Newton’s Law #3: Obtain and demonstrate a Newton’s Cradle. Or, take a new glass catsup bottle. Demonstrate the effects of hitting the catsup bottle on its end or on its side. Also, take a clear, plastic pop bottle partially filled with colored water. Compare the movement of the water when hitting the bottle from the bottom and the side.

9. Do an egg or water balloon toss to show the effects of Newton’s 3rd Law.

10. Do a search for Newton’s Laws activities and simulations on the Internet. There are thousands.

Suggested Assessment:

1. Give an example of a sport for each of Newton’s Laws. Do this orally, artistically, dramatically, or in writing.

2. Design a lab activity to show each of Newton’s Laws.

3. In five minutes, write down every example of Newton’s Law that you can see, think of, or remember from your world.
Concept #4: Technology Design

Objectives
1. Know about the social prejudices throughout time in regard to the investigation of scientific knowledge.
2. Investigate the influences of space technology on everyday life.
3. Explore the concepts of aeronautics including Bernoulli’s principle of lift.
4. Design a toy or tool that employs two of Newton’s Laws.

Idaho Achievement Standards

SCIENCE

625.01: Understand the relationship between science and technology and develop the abilities of technological design and application.

a: Know that science and technology are human endeavors interrelated to each other, to society, and to the work place.
b: Compare scientific inquiry and technological design in terms of activities, results, and influences on individuals and society; know that science enables technology and vice versa.
c: Create a tool to perform a specific function.
d: Use available and appropriate technology.
e: Explore the elements of technological design, which include the following:
   • Identify a problem.
   • Propose a solution.
   • Implement a proposed solution.
   • Evaluate the solution and its consequences.
   • Communicate the problem, process, and solution.
LANGUAGE ARTS

725.01: Read a variety of traditional and electronic materials for information and understanding.

   a: Use decoding strategies and other visual information to fluently read and construct meaning from grade-level text:
      • graphophonic sources (letter/sound);
      • semantic sources (meaning/associations);
      • lexical sources (word analyses);
      • syntactic sources (structure of written language);
      • text elements (graphic elements, illustrations, and titles/subtitles).
   d: Monitor and adjust a response based upon more than one source of information from grade-level text.
   f: Draw inferences and conclusions from text.
   g: Identify literary devices:
      • mood;
      • tone;
      • style;
      • figurative language.
   h: Determine main idea or essential message within a text and identify relevant details and facts.

725.02: Read and respond to a variety of literature to compare and contrast the many dimensions of human experience.

   c: Relate social, cultural, and historical aspects of literature to reader’s personal experience.
   e: Demonstrate understanding of how reading can provide enrichment and information as well as serve as a tool for lifelong learning.

725.03: Read a variety of traditional, technical, and electronic materials for critical analysis and evaluation.

   a: Identify author’s purpose and describe how language, setting, and information support purpose within literary text.
   c: Compare and contrast information from multiple sources.
   d: Use personal or objective criteria to do the following:
      • draw conclusions;
      • make inferences;
      • determine meanings;
      • form opinions;
      • make judgments.
   e: Distinguish between fact and opinion and identify cause and effect relationships within expository text.
725.04: Read to locate information from a variety of traditional, technical, and electronic sources.
   a: Use questions to guide reading:
      • Identify type of information required to answer a specific question.
      • Use reasonable resources for answering questions.
      • Read for purpose of answering specific questions.
   b: Systematically organize new information from expository text.
   c: Synthesize what has been read:
      • Identify main idea and supporting details.
      • Identify important information, patterns, and themes.

726.01: Understand and use the writing process.
   b: Understand and apply steps of the writing process:
      • brainstorm;
      • draft;
      • revise;
      • edit;
      • publish.
   c: Identify and use appropriate style and vocabulary for a particular audience.

726.05: Write to critically analyze and evaluate.
   a: Analyze for the following elements:
      • purpose;
      • ideas;
      • style;
      • structure;
      • effectiveness.
   c: Use writing to persuade.

726.06: Write to gather, synthesize, and communicate research findings.
   a: With teacher support, incorporate a variety of technological and information resources to do the following:
      • Appropriately paraphrase, quote, and cite to avoid plagiarism.
      • Formulate thesis or focus and relevant support.
      • Formulate and support main idea with evidence.
   b: Present research findings.
727.01: Listen for information and understanding.
   b: Develop listening skills to gain enrichment and information about various cultures.

727.03: Listen for critical analysis and evaluation.
   b: Listen for sequencing.

728.01: Speak to share an understanding of information.
   a: Use age-appropriate oral communication for various purposes and audiences that appropriately incorporates the following:
      • a variety of word choices;
      • pronunciation;
      • inflection/modulation;
      • physical gestures;
      • eye contact;
      • posture.
   b: Plan and deliver oral presentations that incorporate the following:
      • transitions;
      • organization;
      • support of main ideas;
      • examples;
      • response to questions and feedback;
      • visual aids and appropriate technology.

728.03: Speak for critical analysis and evaluation.
   a: Clearly express opinions and judgments.
   b: Encourage others’ participation while exhibiting courteous, attentive, and appropriate behavior during discussions.

729.01: View for information and understanding.
   a: Use traditional and visually-presented materials (books, films, videos, Internet).
   b: Use viewing skills to determine main idea and collect data.

729.02: View media sources for personal response and expression.
   a: Identify relationships, ideas, and cultures represented in various media.

729.03: View media to engage in critical analysis and evaluation.
   a: Evaluate relationships, ideas and cultures represented in various media.
625.01: Understand the relationship between science and technology and develop the abilities of technological design and application.

a: Know that science and technology are human endeavors interrelated to each other, to society, and to the work place.

b: Compare scientific inquiry and technological design in terms of activities, results, and influences on individuals and society: know that science enables technology and vice versa.

c: Create a tool to perform a specific function.

d: Use available and appropriate technology.

e: Explore the elements of technological design, which include the following:
   • Identify a problem.
   • Propose a solution.
   • Implement a proposed solution.
   • Evaluate the solution and its consequences.
   • Communicate the problem, process, and solution.

Suggested Activities:

1. Watch the segment of “Apollo 13” that shows the development of a tool from available resources. Give the students a bag of assorted materials and have them construct a tool to perform a specific function that relates to motion and energy. Explain the science behind the inventions.

2. Use Jason Project activities: Jason XI: Going to Extremes curriculum – “Space Simulation”

3. Research the social prejudices against Galileo, Newton, Copernicus, Socrates, Mendel, etc., to see how societies repressed the advancement of science. Have students assume the characters and make an oral presentation to the class. Compare to the current prejudices against stem cell research, GMO usage in foods, irradiation, nuclear energy, etc.

4. Trace the advancements in engineering as it applies to motion, force and energy in the automobile, airline, rail, and bicycle industries. Have other students look at the technology of athletic gear that also is based on this technology. Other applications of this could include space gloves, military equipment, etc.


6. Cut a strip of paper 2 inches wide. Hold next to mouth and blow across the surface. Discuss the principles of lift.
7. Make paper airplanes and modify one variable. Conduct scientific inquiry on the effects of that modification. Record data and write a lab report.

8. Hang two inflated balloons on strings so that the balloons are about two inches apart. Have students hypothesize and justify what will happen when you blow between the balloons. Blow between the balloons to observe Bernoulli’s principle. Discuss.

Suggested Assessment:
1. Work in groups to compare and contrast two scientists – one from the past, one from the present – who did research in the same field. Look at the tools they had available, acceptance of their work, the depth of their study, etc. After researching the topic, have students dress in character and share their findings in a television interview format.

2. For Gifted and Talented students: Make a catalog that advertises NASA-developed inventions showing their cost to develop and today’s cost on the open market.

3. Have students demonstrate their paper airplane designs. Have them create a diagram showing their plane design and the modifications they made to improve lift and flight. (An extension: See NASA Rocket curriculum packet as a guideline to form an aerospace production company.)

4. Use a pre-discussed, pre-distributed rubric to evaluate the students’ toys or tools.

Suggested Resources:
Teaching Physics with Toys and Treats
Idaho Department of Energy – Water Resources Division
Discrepant Events – Tik Liem
NASA sites
Steve Schropshire, ISU Professor of Physics
Physics for Every Kid Janice Van Cleave
Grade 6

Resources

NASA:
Leah Bug-Townsend, Aerospace Education Specialist
NASA Ames Research Center M.S. 253-2
Moffett Field, CA 94035-1000
Education Resource Center
leahbug@aesp.nasa.okstate.edu
(650) 604-6077
(650)-604-3574

Jason Project:
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Project Wet:
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