K-6 Science and Technology Curriculum (2004)

Northwest Territories

Education, Culture and Employment.

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Stacy Apple John	Science Consultant, Beaufort Delta Divisional Education Council
Dan Surrette	Consultant, Beaufort Delta Divisional Education Council
Chuck Lirette	Diamond Jenness High School, South Slave Educational Council
Emily Hall	Chief Jimmy Bruneau School, Dog Rib Divisional Education Council
Cheryl Mackie	Mackenzie Mountain School, Sahtu Divisional Education Council
Alan Cook	Math, Science Coach, Yellowknife Public Denominational District Education Authority
Roger Windle	William MacDonald School, Yellowknife District No.1 Education Authority

Production Support

Robert Worsley	Data Analyst, Systems, ECE

The NWT Grades K-6 Science and Technology Curriculum (2004)

Introduction:

Students graduating from NWT schools require the scientific and technological, knowledge and skills that will enable them to be productive members of society. They also need to develop the type of mindset that will motivate them to use their knowledge, skills, and attitudes in a responsible manner. The NWT Science and Technology 2004 Curriculum, Grades K-6 outlines the knowledge, skills, and attitudes that students must develop in Grades K-6, as well as the levels of achievement at which the students are expected to master these knowledge, skills and attitudes . Teachers will use these levels of achievement to assess a student's accomplishments.

Students must develop a thorough knowledge of basic concepts, which they can apply throughout their lives in a wide range of situations. They must also develop the broad-based skills and varied experiences that are so important for effective functioning in the world today. They must learn to identify and analyze problems and to explore and test solutions in a wide variety of contexts, while retaining their cultural values and heritage. The conceptual base and essential skills are paired with cultural values, beliefs, and heritage to become the corner stone of the science and technology curriculum. These elements must be the focus of teaching and learning in the classroom and beyond the school. The knowledge, skills, and attitudes outlined in this document are also consistent with the goals of science education in Canada, outlined in the Common Framework of Science Learning Outcomes, K-12 (Council of Ministers of Education, Canada, 1997).

This document replaces the NWT 1992 revised K-6 science curriculum. All science and technology programs for Grades K-12 will be based on the expectations outlined in this document.

What Is Science and Technology?

Science is a form of knowledge that seeks to describe and explain the natural and physical world and its place in the universe. Occasionally, the fundamental theories, concepts, and structures of science change and, for the most part, have proven stable. However, the changes that have taken place will demonstrate to students that science is not static, nor absolute, but an ongoing process of discovery and refinement. The curriculum outlined in this document will introduce students to many of these basic ideas along with the processes of discovery and learning.

Technology includes much more than the knowledge, skills, and attitudes related to computers, electronics, and their applications. Technology is both a form of knowledge and application that uses concepts and skills from many disciplines and cultures to design and construct useful "tools" that meet an identified need or solve a specific problem. The methods used to develop technology consists of inventing or modifying devices, structures, systems, or processes to meet a human need and transcends cultural, geographic, and linguistic differences. Students are expected to design, explain, and make modifications to devices to improve their functionality through experimentation and experiential learning.

Science is not only a body of knowledge but also a way of knowing and experiencing the world we live in. Scientific investigation involves exploration, experimentation, observation, measurement, analysis, and

dissemination of data. These activities require specific skills and habits of mind. Accuracy, discipline, and integrity in the application of scientific principles are fundamental to scientific activity. This curriculum is designed to develop these skills and habits of mind, where students are expected to conduct hands on learning and describe, using their own observations, the behaviour and basic characteristics of what they are investigating.

Technologies, historical and present, are also "a way of knowing" and a process of exploration, experimentation, and refinement. Technological investigation involves the application of methods known as design processes, which in turn involve the use of concepts and procedures such as the identification of a need or problem and the selection of a best solution and refinement. This process transcends all cultural and historical perspectives to include traditional and modern day forms of technological tools. Therefore, students are expected to design, make, test, modify, and retest devices to meet certain specifications based on need.

Science and technology both exist in a broader social, cultural, and economic context. They are affected by the values and choices of people and governments and in turn have a significant impact on local as well societal issues. The world as we know it today has been affected in many important ways by science and technology. Science has radically altered and expanded our understanding on all fronts, from our daily lives to a greater understanding of the far reaches of space and time. It is important therefore, that students see science and technology in this wider context, as endeavors with important consequences for people and that they learn to relate their knowledge of science and technology to the world beyond the school and appreciate the discoveries and accomplishments of our ancestors.

The Goals of Science and Technology Education

The goals of science and technology education in Grades K-6 stem from the nature of science and technology and from the needs of NWT students. The goals are intended to ensure that all students acquire a basic scientific literacy and technological capability before entering secondary school. The goals for students are to:

Understand the basic concepts of science and technology;

Develop the skills, strategies, and habits of mind required for scientific inquiry and technological design through experiential and discovery learning;

Relate scientific and technological knowledge to each other and to the world outside the school; and

Appreciate the contributions and accomplishments of all people in the advancement of science and technology.

Each of these goals are equally important. They can be achieved simultaneously through learning activities that combine the acquisition of knowledge and context-based experiential learning. Through inquiry and design processes, that are anchored to concrete and practical contexts, students build and use their past experiences to add to their own understanding and knowledge of science and technology. These learning activities must also enable students to develop the communication skills that are an essential component of science and technology education.

Features of the 2004 Curriculum for Science and Technology

The science and technology curriculum described in this document differs from previous curricula in several important ways. These are outlined below:

The knowledge, skills, and attitudes that students are expected to acquire are identified for each grade;

In general terms the curricula outcomes are identified for the end of Grades 3 and 6;

The subject areas of science and technology are combined. Some of the expectations focus on science, some on technology, while others deal with relating science and technology to each other and to the world outside the school;

Some concepts, skills, and attitudes are introduced earlier and taught in depth allowing for more rigorous treatment;

Technology concepts and processes are included and are introduced earlier in a practical context;

There is greater emphasis on earth and space science;

Greater emphasis is placed in the expectations on relating science and technology to each other, the technological and scientific accomplishments of our ancestors, to the world outside the school and on the need for sustainable development;

Students' understanding of the concept of sustainability is stressed in a variety of contexts;

Communication skills and the use of appropriate and proper terminology are given greater emphasis where students are expected to describe what they are doing by using the terminology associated with specific scientific, cultural, and technological concepts;

Educators are encouraged to identify and use local examples of scientific and technological accomplishments, to assist and enable students to bridge prior learning with new concepts; and

The curriculum identifies the big idea for each unit to allow for greater flexibility in teaching specific outcomes.

The Role of Families

Studies show that students perform better in school if their families are involved in their education. Family members therefore, have an important role to play in supporting their child's learning. By sharing the curriculum's "Big Ideas," family members can find out what their children are learning in each grade and why they are learning it. This awareness will enable family members to discuss their children's work with them, to share their own experiences, to communicate with teachers, and to ask relevant questions about their child's progress. Knowledge of the expectations in the various grades will also help family members to interpret their child's progress and to work with the teacher to improve the student's learning.

There are many other ways in which family members can express their interest in their child's education. Participating in parent conferences, providing context for learning and encouraging children to complete their assignments at home are three obvious examples.

The science and technology curriculum promotes lifelong learning and an appreciation for the accomplishments of our ancestors, not only for students, but also for their family and all those with an interest in education. In addition to supporting regular hands-on classroom activities, parents and community members are encouraged to promote science fairs, Olympiads, traditional, cultural and other events that focus on technological skills.

Family members can also provide valuable support for their children's learning by taking an interest in their out-of-school assignments. Such an interest promotes safe techniques in the handling of tools and the disposal of harmful substances, as well as the handling and respect of animals and plants. Many home projects demonstrate the close link that exists between science, culture, and technology. For example, to decide how to reduce the loss of heat

energy, students need to understand first of all how heat energy is transmitted through different materials (science); then they can examine which natural or manufactured product (cultural) that best insulates, and with the materials perform an experiment (technology) to test their questions.

The Role of Teachers

Teachers and students have complementary responsibilities. Teachers are responsible for developing appropriate instructional strategies, which are relevant and engaging to the student. They need to address different student needs, prior learning and experiences, bring enthusiasm and a variety of teaching approaches and contexts to the classroom. Teachers know that they must persevere in their efforts and make every reasonable attempt to ensure sound learning and experiences for every student. Teachers will provide as many hands-on activities as possible because the attitude, inquiry, and design skills emphasized in this curriculum must be taught and learned through experiences with concrete materials. The activities provided should allow students to discover and learn fundamental concepts through investigation, exploration, observation, and experimentation. The students should then be shown how to place these concepts in the social, cultural, environmental, and economic contexts in which their relevance and application will be most evident. Opportunities to relate knowledge, skills and attitudes to these wider contexts, will motivate students to learn in a meaningful way and to learn for life.

The Role of Students

Students also have responsibilities with regard to their learning, which increases as they advance through elementary and secondary school. Students who are willing to make the effort required, able to apply themselves, and to experience success will soon learn that there is a direct relationship between perseverance and achievement and will be motivated to investigate in and enjoy science. There will be some students however, who will find it more difficult to take responsibility for their learning because of the special challenges they face, which may include lack of support and other difficulties in their environment. For these students, the attention, patience, and encouragement of teachers can be extremely important factors for their success. Invest the time in finding out the strengths of the student and use their subject matter expertise toward a mutual goal. However, regardless of their circumstances, learning to take responsibility for one's own progress and learning is an important part of education for all students.

It is imperative that students demonstrate a commitment to safe practices and to team collaboration skills. Demonstration of these attitudes and skills will facilitate the hands-on approach necessary for the mastery of scientific and technological concepts and skills. Students should also actively pursue opportunities outside the classroom to extend and enrich their understanding of scientific and technological concepts and to explore how science and technology are related.

Curriculum Expectations and Achievement Levels

The NWT Science and Technology 2004 Curriculum, Grades K-6 has two main elements: expectations and achievement levels. The expectations are identified for each grade. These expectations describe the knowledge, skills, and attitudes that students are expected to develop and to demonstrate in their class work and investigations, on tests, as well as in various other activities on which their achievement is assessed.

Three sets of expectations are listed for each grade in each strand or broad area of the curriculum.

The Big Idea describes the overall concept of what students are to be investigating. This paints the “global picture” of the intended outcomes.

The General Learning Outcomes correspond to the three goals of the science and technology program and describe in general terms the knowledge, skills, and attitudes that students are expected to achieve by the end of each grade.

The Specific Learning Outcomes describe the expected knowledge, skills, and attitudes in greater detail. The specific Learning Outcomes are organized under three subheadings:

Understanding Basic Concepts;
Developing Skills of Inquiry, Design, and Communication; and

Relating Science and Technology to the World Outside the School.

This organization is not meant to imply that the expectations in any one group are achieved independently of the expectations in the other two groups. The subheadings are used merely to help teachers focus on particular aspects of knowledge, skills, and attitudes as they plan learning activities for their students.

The achievement levels are brief descriptions of the four different degrees of achievement within the territorial curriculum expectations for any given grade. These descriptions are among a number of tools that teachers will use to assess students' learning. The achievement levels for science and technology focus on the three goals of science and technology education:

Understanding the basic concepts of science and technology;

Developing the skills, attitudes, and strategies required for scientific inquiry and technological design, including the techniques involved in the safe use of appropriate tools and equipment; and

Developing the ability to relate science and technology to each other and to the world outside the school.

Also included are the communication skills that are an essential component of science and technology education. Level 3, which is the "territorial standard,” identifies a high level of achievement within the territorial expectations. Parents of students achieving at level 3 in a particular grade can be confident that their children will be prepared for work at the next grade. Level l identifies achievement that falls much below the territorial standard. Level 2 identifies achievement that approaches the standard. Level 4 identifies achievement that surpasses the standard.

Achievement Indicators

Achievement Levels

The chart that follows identifies four areas of achievement in science and technology: understanding of basic concepts; inquiry and design skills; communication of required knowledge; relation of science and technology to each other and to the world outside the school. For each of these four areas, there are four levels of achievement. These levels contain brief descriptions of degrees of achievement on which teachers will base their assessment of each student’s work.

The descriptions in the achievement levels are meant to be used to assess each student's achievement of the expectations outlined in this document in each grade and strand. Teachers should use the descriptions to identify the level at which a student has achieved a particular expectation, or a group of expectations, in the appropriate category of knowledge or skills. If the student can give a complete or nearly complete explanation, the student's achievement of that expectation would be at

level 3 in the area of understanding of basic concepts. Normally a teacher will apply more than one of the descriptions to a student's achievement of a group of expectations to determine the level that most appropriately describes the student's achievement.

The characteristics given for level 3 represent achievement that is considered to be the standard for the grade. A student's work at level 3 in science and technology in any grade may be described in general terms as follows:

The student understands most of the basic concepts in science and technology, demonstrates no significant misconceptions, and usually gives complete or nearly complete explanations of them;

The student applies most of the required skills of inquiry and design, usually shows awareness of safety procedures, and uses tools, equipment and materials correctly with only occasional assistance;

The student generally communicates clearly and precisely, using appropriate science and technology terms and units of measurement; and the student shows understanding of connections between science and technology in familiar contexts, as well as connections between science and technology in the world outside the school.

Although the chart is intended to be used mainly for assessing student achievement, teachers may wish to use it for other related purposes, such as a guide when collecting samples of student work to demonstrate to parents what abilities are displayed at certain levels.

Achievement Levels: Science and Technology, Grades K-6

Knowledge / Skills / Attitudes The student will demonstrate:	Level 1	Level 2	Level 3	Level 4
Understanding of Concept	- shows understanding of a few basic concepts. - demonstrates significant misconceptions. -gives explanations showing limited understanding of the concept.	- shows understanding of some of the basic concepts. - demonstrates minor misconceptions. - gives partial explanations.	-shows understanding of most of the basic concepts. - demonstrates no significant misconceptions. - usually gives complete or nearly complete explanations.	- shows understanding of all basic concepts. - demonstrates no misconceptions. - always gives complete explanations.
Inquiry, design and attitude skills	- applies few of the required skills and strategies. - shows little awareness of safety procedures. - uses tools, equipment and materials correctly only with assistance.	- applies some of the required skills and strategies. - shows some awareness of safety procedures. - uses tools, equipment and materials correctly with some assistance.	- applies most of the required skills and strategies. - usually shows awareness of safety procedures. - uses tools, equipment and materials correctly with only occasional assistance.	- applies all (or almost all) of the required skills and strategies. - consistently shows awareness of safety procedures. - uses tools, equipment and materials correctly with little or no assistance.
Communication of Required Knowledge	-communicates with little clarity and precision. - rarely uses appropriate science and technology and units of measure.	-communicates with some clarity and precision. - sometimes uses appropriate science and technology and units of measure.	- generally communicates with clarity and precision. - usually uses appropriate science and technology and units of measure.	- consistently communicates with clarity and precision. - consistently uses appropriate science and technology and units of measure.
Relating Science and Technology to each other and to the world outside	- shows little understanding of connections between science and technology in familiar contexts. - shows little understanding of connections between science and technology and the world outside the school.	- shows some understanding of connections between science and technology in familiar contexts. - shows some understanding of connections between science and technology and the world outside the school.	- shows understanding of connections between science and technology in familiar contexts. - shows understanding of connections between science and technology and the world outside the school.	- shows understanding of connections between science and technology in both familiar and unfamiliar contexts. - shows understanding of connections between science and technology and the world outside the school as well as their implications.

Strands in the Science and Technology Curriculum

The science and technology expectations are organized into five strands, which are the major areas of knowledge, skills, and attitudes in the science and technology curriculum. The five strands, which combine topics from science and technology, are:

Life Systems

Matter and Materials

Energy and Control

Structures and Mechanisms

Earth and Space Systems

The knowledge, skills, and attitudes outlined in the expectations for the science and technology program are mandatory.

Table 1 shows the topics treated in each strand in each grade for Grades K-6.

Table 1. Strands and Topics: Science and Technology, Grades K-6

Strand	Grade Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
Life Systems	Senses and the body	Character and Needs of Living Things	Growthand changes in Animals	Growth and changes in Plants	Habitat and Community	Human Organ Systems	Diversity of Living Things
Matter and Materials	Creating Colour	Characteristics of Objects and Properties of Materials	Properties of Liquids and Solids	Magnetic and Charged Materials	Materials that Transmit, Reflect or Absorb Light or Sound	Properties of Change in Matter	Properties of Air and Characteristics of Flight
Energy and Control	Keeping Warm	Energy in our Lives	Energy from Wind and Water	Forces and Movement	Light and Sound Energy	Conservation of Energy	Electricity
Structures and Mechanisms	Machines Around Us	Everyday Structures	Movement	Stability	Pulleys and Gears	Forces Acting on Structures and Mechanisms	Motion
Earth and Space Systems	Dinosaurs	Daily and Seasonal Cycles	Air and Water in the Environment	Soils in the Environment	Rocks, Minerals and Erosion	Weather	Space

The expected instructional time allocations by grade per year are:

Grade	Instructional hours per year
Kindergarten	45 hrs
Grade 1	90 hrs
Grade 2	90 hrs
Grade 3	90 hrs
Grade 4	90 hrs
Grade 5	90 hrs
Grade 6	90 hrs

The Importance of Safety

Teachers are responsible for ensuring the safety of students during classroom and outdoor activities and also for encouraging and motivating students to assume responsibility for safety as an individual and as a group. Instructors at all levels and in all situations must also teach students the knowledge, skills, and attitudes needed for safe participation in science and technology activities. For these reasons, teachers must model safe practices at all times and communicate safety expectations to students in accordance with school board and Department of Education, Culture and Employment policies.

To carry out their responsibilities with regard to safety, it is important not only that teachers and other instructors have concern for their own safety and that of their students, but also that they have:

The knowledge necessary to plan indoor and outdoor activities and use the materials, tools, and procedures involved in science and technology safely;

Knowledge and cultural awareness concerning the care of living things (plants and animals) that are brought into the classroom or experienced out of doors; and

The skills needed to perform tasks efficiently and safely.

Note: Teachers supervising students using power equipment need to have specialized training in handling such tools or equipment.

Students demonstrate that they have the knowledge, skills, and habits of mind required for safe participation in science and technology activities when they:

Maintain a well-organized and uncluttered work space;

Follow established safety procedures;

Identify possible safety concerns;

Suggest and implement appropriate safety procedures;

Carefully follow the instructions and example of the teacher; and

Consistently show concern for their safety and that of others.

Specific safety concerns associated with the activities of a particular strand are identified in the introduction to that strand. In addition, skills, and practices related to safety are also included in the expectations when knowledge, skills, and attitudes related to safety are part of the learning that students are to acquire in the science and technology program.

Attitudes in Science and Technology

Students need to develop the attitudes or "habits of mind" that are considered essential for meaningful work in science and technology. These include: commitment to accuracy, precision, and integrity in observation, experimentation, and reporting; respect for evidence; concern for the observance of safety procedures; respect of others point of view, as well as respect for living things and the environment. These habits of mind have been incorporated into the Specific Learning Outcomes, especially those grouped under the heading Developing Skills of Inquiry, Design, and Communication. Activities that involve students in investigating issues related to science and technology in the world outside the school provide opportunities for them to develop the attitudes, cultural and personal values needed to make informed and responsible decisions.

Students' attitudes towards science, technology, and education can have a significant effect on their ability to achieve the expectations. Teaching methods and learning activities that encourage students to recognize the value and relevance of what

they are learning in a defined context will go a long way towards motivating students to work and to learn effectively.

The Importance of Communication Skills

Communication is an essential component of the science and technology curriculum because many of the activities and tasks that students undertake involve the use of communication skills, written, pictorial, graphical and/or oral. Students use language to record their observations, to describe their investigations in both informal and formal contexts, and to present their findings through written and/or oral presentations and reports. Students therefore need to be able to communicate effectively and have opportunities throughout the year to sharpen their skills. The language of science and technology includes special terms that are recognized
as belonging to these fields, as well as many words that have ordinary meanings but that, in the context of science and technology, are used in new or more specific ways. The study of science and technology will thus encourage students to use language and terminology with greater care and precision. The use of aboriginal language, in context, will also enable students to appreciate and better understand the sciences from a variety of cultural contexts.

The science and technology curriculum also builds on and reinforces certain aspects of the first and second language arts, social studies and mathematics curricula. The emphases on clear, concise communication, and the use of various charts, tables, and graphs for communicating observations and measurements provides opportunities to enhance differentiated instruction. It also includes other forms of communication such as the use of SI metric units, technical drawing, and experimental reporting. Care has been taken to ensure that expectations involving SI metric units and other communication related knowledge, skills and attitudes are consistent with the expectations in language and mathematics for the grade.

The Use of Computers in the Science and Technology Curriculum

The use of computers can extend and enrich students' learning in science and technology. Whenever possible, students should be encouraged to use computers in a purposeful manner to enhance their understanding of the science and technology program. The World Wide Web enables students and teachers to research and learn about science and technology in the world beyond the school. They can communicate with students in other schools and in other parts of the world through the Internet to broaden their understanding of global scientific issues. In addition, students can use computer programs to compile, organize, and store data gathered through investigations; to write reports and papers in which they present their findings (using word-processing programs and spreadsheets); and to work with simulations in areas of study in which hands-on activities are not feasible (e.g., in astronomy) or in which there is too great a safety risk (e.g., investigations involving toxic substances).

Planning Student Programs

In planning science and technology programs, teachers need to provide students with the fundamental knowledge, skills, and attitudes that will enable them to carry out increasingly complex and challenging investigations. Teachers will provide activities and assignments that are personally challenging to the student while encouraging students to learn the basic concepts of science and technology and to develop the skills required for scientific inquiry and technological design. To ensure that the science and technology program is interesting and relevant, teachers must relate scientific and technological knowledge, skills, and attitudes to issues and problems of the world outside and to the need for sustainable development. Although care must be taken to ensure that the concepts and skills taught are appropriate to

students' stage of development, this emphasis on the relationship of science and technology to the world outside the school must be paramount throughout the program if students are to recognize that science and technology are not just school subjects, but fields of knowledge that affect their lives, communities, history, culture, and the world.

Students in Grades K-6, in particular, will benefit from a program in which their immediate world is integrated in the understanding and applications of science and technology. An integrated program can help students make connections between the concepts, skills, and attitudes of other disciplines and their culture. Students will have opportunities to see the parallels between the processes of inquiry and design. They will also be able to investigate the scientific concepts that underlie and lead to an understanding of technological accomplishments. In schools where subjects are taught separately by specialist teachers it is imperative that teachers plan their programs collaboratively to ensure that students are able to meet all of the grade expectations, while reducing repetition for students and teachers.

The development of skills, attitudes, and knowledge in science and technology is often related to learning in other subject areas. When planning programs, teachers should emphasize this cross-curricular learning by:

Coordinating the teaching of related content in two or more subjects. Data management in mathematics can be linked to making a graph of data collected in a science and technology activity. Similarly, students being taught library skills in language can transfer those skills to gather data about a science or technology topic; and

Providing opportunities for students to work towards expectations in two or more subjects within one lesson. For example, social studies teachers developing a unit on what type of houses people have around the world could give students opportunities to learn about the properties of materials (science and technology), the characteristics of geometric shapes (mathematics), and the aesthetics of design (visual art and technology). At the conclusion of the lesson, students could be asked to write a paper (language) assessing the impact of a scientific or technological innovation on the lifestyle of people (science and technology/social studies).

To help teachers plan such integrated units of study, the expectations in science and technology have been carefully aligned with related expectations in language arts, Dene Kede, Inuuqatigiit, mathematics and other curricular areas. Science and technology should not be taught in isolation but rather be seen by the student as an extension of their evolving world as they grow as a learner.

Science and Technology for Exceptional Students

Recognizing the needs of exceptional students and providing appropriate programs for them are important aspects of implementing the curriculum. For some students, the appropriate choice of instructional methods and settings will suffice to ensure achievement of the expectations. For others, some or all of the expectations will need to be modified. To achieve at the highest possible level, some exceptional students may need to participate in special programs.

The process whereby a student is formally identified as exceptional is clearly outlined in "Educating All Our Children: Departmental Directive on Inclusive Schooling 1996." Through this process, parents, teachers, and other support personnel identify the specific needs of a student, create an Individual Education Plan (IEP) that addresses these needs, and review progress according to a predetermined plan. While specific procedures pertaining to the creation of an IEP are not defined in legislation, the Department of Education, Culture and Employment (ECE) and boards

have established practices and developed appropriate processes pertaining to IEPs. However, an IEP must have written parental/guardian consent prior to its implementation (Education Act - Subsection 9(3)).

In the case of students who have been formally identified as exceptional, it is particularly important that school staff work in consultation with parents to support the students' learning. There must be clear and ongoing communication between all parties involved in the students' care to ensure that appropriate support and programs are in place. Assessment and evaluation adaptations for such students need to be discussed with parents and with students at appropriate intervals. Parents need to understand how these adaptations affect the assessment and evaluation of the students' work.

Some students who have not been formally identified as exceptional, but who have special short-term learning needs because of medical or other reasons, may also require an IEP. The IEP must be discussed with parents when it is introduced into the student's program, and any adaptations in assessment, and evaluation must also be discussed at that time.

In science and technology, exceptional students may need a variety of modifications both to the program itself and to the learning environment. These may include the following:

Facilities that allow for the mobility of students with physical impairments;

Modifications to programs for pupils with learning disabilities who may require more hands-on opportunities for learning;

Program adaptations for students who are deemed gifted;

Visual signs related to safety issues;

Assessment and evaluation strategies that accommodate a variety of learning styles and needs;

Programs that are challenging to the specific needs of the student; and

Students who can demonstrate or are deemed gifted need to have a program modified to their needs to ensure that they are adequately challenged. This should be done in consultation with the student, parents and teacher to focus on extension activities that stimulate the interests of the learner.

LIFE SYSTEMS

The Life Systems strand combines the study of traditional topics in life science or biology (e.g., animals, plants, ecosystems) with technology as it relates to basic human needs (e.g., food, shelter, and clothing). Students begin their study of life systems with aspects that are familiar to them (e.g., animals and plants in their environment, their own bodies) and gradually move on to study global or abstract aspects such as ecosystems. Of particular importance in the Life Systems strand is the investigation of interactions between living things and their environment.

The topics covered in this strand are:

Kindergarten:	Senses and the Body
Grade 1:	Characteristics and Needs of Living Things
Grade 2:	Growth and Changes in Animals
Grade 3:	Growth and Changes in Plants
Grade 4:	Habitats and Communities
Grade 5:	Human Organ

Systems

Grade 6: Diversity of Living Things

Investigations are a very important part of the Life Systems strand. In the early elementary grades, these take the form of explorations of familiar living things. As students gain the necessary knowledge, skills, and attitudes, their investigations become more complex and more methodical and include simple in-class laboratory experiments along with outdoor activities
and investigations.

It is important that students follow established safety practices in all investigations. These practices include:

Washing one's hands after handling plants, animals, soils and materials;

Following instructions during indoor and outdoor investigations;

Handling plants and animals with care; Following safety procedures for touching or smelling any substance;

Working only under supervision inside and outside the classroom (such as a pond or other body of water during outdoor activities);

School staff is informed of any allergies students may have, and take those allergies into consideration when handling plants, animals, and any substance. (In the case of younger students, parents and guardians should ensure that appropriate school staff and the student are informed of any allergies); and

Being aware of cultural values when dealing with plants, animals or materials.

The Life Systems strand includes a study of the relationship between science and technology and the role of science and technology in the broader world context, as well as the impact of technological changes on the environment and the need for sustainable development.

In all grades, students will develop the ability to use spoken, written and pictorial language to communicate clearly and to use scientific terminology appropriately.

NOTES:

LIFE SYSTEMS

Kindergarten - Senses and the Body

Overview

The study of Life Sciences in Kindergarten focuses on the investigation of the five senses. Students will explore the five human senses and how they are important to our daily lives. Students will explore how we use the senses to make sense of the world around us. Their observations, through investigations, will allow students the opportunity to gain an understanding of how the various senses work and interact.

Big Idea

Humans have 5 senses: sight, hearing, touch, taste, and smell.

General Learning Outcomes

By the end of Kindergarten, students will: Demonstrate a basic understanding of the 5 senses.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Kindergarten, students will:

Name the five senses; and

Describe the basic characteristics of each of the five senses.

Developing Skills of Inquiry, Design, and Communication

By the end of Kindergarten, students will: Ask questions about the five senses; Plan investigations to test how the five senses interpret and distinguish between various items (e.g., cold, warm, hot, sweet, sour, bitter, colours, shapes, textures);

Use appropriate terminology in describing their investigation, exploration, and demonstrations;

Record relevant observations, findings and measurements, using written language, pictorial representations, charts, drawings or concrete materials, (e.g., list foods as sweet, sour, bitter; sounds as soft, quiet, loud etc.); and

Communicate the procedures and results in investigations for specific purposes, using demonstrations drawings, oral/written reports (e.g., describe results of taste tests).

Relating Science and Technology to the World Outside the School

By the end of Kindergarten, students will: Identify instances where we use our senses to investigate the world around us;

Identify instances where our senses help us appreciate the world around us;

Compare ways in which people and other animals use their senses to meet their needs; and

Describe ways in which our senses can protect us.

NOTES:

LIFE SYSTEMS

Grade 1 - Characteristics and Needs of Living Things

Overview

The study of Life Systems in Grade 1 focuses on an investigation of the characteristics and basic needs of living things. Students will explore aspects of movement and behaviour in humans and other animals, and will learn about their nutritional requirements. Students will also explore some basic aspects of growth in animals and plants. In all their investigations, students will continually refine their ability to observe, using all five senses, and will attempt to describe their observations as accurately as possible.

Big Idea

Each species has unique characteristics and all have the basic needs of water, “air” and energy for survival.

General Learning Outcomes

By the end of Grade 1, students will:
Demonstrate an understanding of the basic needs of animals and plants (e.g., the need for food/energy, air, and water);

Investigate the characteristics and needs of animals and plants; and

Demonstrate awareness that animals and plants depend on their environment to meet their basic needs, and describe the requirements of good health for humans.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 1, students will:

Classify the characteristics of various domestic and northern plants and animals by using the senses (texture, colour, size, sound, shape, smell etc.);

Describe the way in which different local animals move to meet their basic needs (e.g., caribou migration, fox and bear ranges, whale and fish migration);

Identify and describe common characteristics of humans and other local animals that they have observed and identify variations in these characteristics (e.g., hair, eyes, movement, location, habits);

Describe some basic changes in humans as they grow and compare these changes in humans with changes in other living things (e.g., growth of body parts, teeth, stages of development); and

Describe patterns that they have observed in living things (plants have seeds, animals move from place to place, northern land mammals have fur/hair and many migrate).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 1, students will:

Select and use appropriate tools to increase their capacity to enhance observations (e.g., using a magnifying glass, growing plants and caring for an animal in the classroom e.g., fish in a tank;

Ask questions about and identify some basic needs of living things along with ways of meeting their basic needs and explore possible answers to these questions;

Predict how animals may move based on two or more characteristics (e.g., fins, gills, scales, suggest an animal that swims);

Plan investigations to answer some of these questions to determine the basic needs of plants and animals;

Use appropriate terminology in describing their investigation, explorations and observations (e.g., legs, wings, antenna, antlers, hooves, roots stems, trunk, etc.);
Record relevant observations, findings and measurements, using written language, pictorial representations, charts, drawings, and or concrete materials (draw and label a picture of a plant and indicate where it could be found etc.); and

Communicate the procedures and results in investigations for specific purposes using demonstrations, drawings, oral/written reports (e.g., demonstrate different bird nests, tundra vs. boreal forest).

Relating Science and Technology to the World Outside the School

By the end of Grade 1, students will:
Compare the basic needs of humans with the basic needs of other living things;
Identify local plants and animals by seeing only a part of it (e.g., feathers, fur, pressed leaves).

LIFE SYSTEMS

Grade 2 - Growth and Changes in Animals

Overview

The study of animals in Grade 2 focuses on patterns of growth and change. Because children are interested in the changes that take place in different types of animals, observing these changes can be a powerful learning experience for them. In their exploration of growth, students will also compare patterns of growth in different animals with their own growth and they will learn about the conditions needed to support healthy development in an animal.

Big Idea:

Successful Adaptation is dependent on similarities and differences in and between species.

General Learning Outcomes

By the end of Grade 2, students will:
Demonstrate an understanding of the similarities and differences among various types of animals and the ways in which animals adapt to different environmental conditions;

Investigate physical and behavioural characteristics and the process of growth of different types of animals; and

Identify ways in which humans can affect local animals.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 2, students will:

Identify and describe the major physical characteristics of different types of animals (e.g., mammals, reptiles, insects);
Identify and describe behavioural characteristics that enable animals to survive and adapt to their environment (e.g., migration, hibernation);

Classify a variety of animals using observable characteristics of similarities and differences (e.g., size, body covering, teeth);

Compare ways in which animals eat their food, move and use their environment to meet their needs (e.g., teeth indicate herbivore or carnivore, migration allows animals to follow food sources, mollusks filter feed);

Describe changes in the appearance and activity of an animal as it goes through a complete life cycle (insects metamorphosis, mammals, fish, birds etc.);

Compare the life cycle of some local animals that have similar and dissimilar life cycles (dogs/wolves, fish/birds, insects/mammals etc.);

Identify constant and changing traits in the same species of animals as they grow and mature (young vs. mature) (e.g., size, colour, foods, ability to move etc.);

Describe ways in which animals respond and adapt to their environment throughout the seasons (camouflage, fur, location); and

Compare ways in which different animals care for their young (use a variety of local and non-local, birds, fish, insects, mammals).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 2, students will:

Ask questions about and identify some needs of different animals with which they

are familiar and explore possible answers to these questions and ways of meeting these needs (form vs. function e.g., teeth of carnivores vs. herbivores);

Plan investigations to answer some of these questions or find ways of meeting these needs, and describe the steps involved;

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., name and identify part of various plants and animals, name life cycle phases of local organisms);

Record relevant observations, findings, and measurements using written language, pictorial representations, drawings, charts, diagrams, and/or concrete materials (e.g., labeled drawings showing the life cycle or body parts of an animal); and

Communicate the procedures and results of investigations for specific purposes using drawings, demonstrations, and oral or written descriptions (e.g., explain how a caterpillar/dog/fish feeds, using a model constructed of modeling clay).

Relating Science and Technology to the World Outside the School

By the end of Grade 2, students will: Describe features of the environment that support the growth of familiar animals (e.g., fish and insects in a water environment); Identify and compare the effects of the seasons on animals (e.g., thicker coat/fur, colour change, migration, hibernation); Describe ways in which humans can help or harm other living things (e.g., protecting endangered species, selective and traditional aboriginal harvesting techniques to ensure sustainability);

Demonstrate an understanding of the requirements of small animals for survival by maintaining an aquarium or a terrarium;

Describe the life processes of an animal that they have observed (e.g., the eating habits, movement, rest patterns, and location);

Demonstrate awareness for proper ways of caring for animals (pets, wild animals, harvesting); and

Describe ways in which humans acquire food (e.g., raising livestock or harvesting wild animals).

LIFE SYSTEMS

Grade 3 - Growth and Changes in Plants

Overview

The study of plants in Grade 3 focuses on the characteristics and requirements of plants and their patterns of growth. Students will observe and investigate a wide variety of local plants, from trees to mosses, in their local natural environment. They will also learn about the importance of plants not only as sources of food and shelter for people and animals, but as suppliers of much of the world's oxygen.

Big Idea

The similarities and differences in physical characteristics of different plant species are dependent upon their environment.

General Learning Outcomes

By the end of Grade 3, students will:
Demonstrate an understanding of the similarities and differences in the physical characteristics of different plant species and the changes that take place in different plants as they grow;

Investigate the requirements of plants and the effects of changes in environmental conditions on plants; and

Describe ways in which plants are important to other living things and the effects of human activities on plants.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 3, students will:

Identify the major parts of plants (e.g., seeds, stem, leaves, pistil etc.) and describe their basic function;

Classify plants according to visible characteristics (e.g., bark, leaf shape, root systems, type of flowers, seeds or berries);

Describe using their own observations, the changes that plants (local/domestic) undergo in a complete life cycle (e.g., blueberry, cranberry, tomato seeds, germination, growth, seed production, seed disbursement);

Describe, using their own observations, the effects of the seasons on plants (germination/budding, leaf/stem growth, production of seeds, preparation for dormancy/end of life cycle);

Compare the life cycle of different kinds of plants (bulbs, seeds, tubers, spores, cones, cuttings);

Identify traits that remain constant in some plants as they grow (leaf shape, leaf size, flower colour);

Describe using observations, how the growth of plants are affected by the changes in the environment (e.g., soil type, permafrost, rain fall, sunlight, wind); and

Explain how different features of plants help them survive (cold weather germination, fuzzy leaves, live close to the ground, quick life cycle, dormancy, adapt to 24 hour daylight/darkness and permafrost).

Developing Skills of Inquiry, Design, and Communication

Design and conduct a hands-on inquiry into seed germination or plant growth;

Ask questions about and identify some needs of plants, and explore possible answers to these questions and ways of meeting these needs (e.g., predict how long a particular type of plant could go without water before its leaves start to droop, plants tolerant to cold/frost);

Plan investigations to answer some of these questions or find ways of meeting these needs and explain the steps involved;

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., stem, pistil, stamen, petals, leaves);

Record relevant observations, findings, and measurements, using written language, pictorial representations, drawings, charts, and graphs (e.g., produce a series of drawings to show a plant at different stages of development); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using drawings, demonstrations, simple electronic media, oral and written descriptions (e.g., make a graph that shows the number and kinds of trees or plants found in your community; design and construct a terrarium or garden that reproduces the conditions that they found to be requirements of specific plants).

Relating Science and Technology to the World Outside the School

By the end of Grade 3, students will:
Describe ways in which humans use plants for food, shelter, and clothing, historically, culturally and today (e.g., trees are used for building houses and tents; cloth is made from cotton;);

Describe ways in which humans can protect natural areas to maintain native plant species (e.g., establishing conservation areas, wildlife reserves, wetland sanctuaries, self regulation, keeping and respecting traditional values of the land);

Identify the parts of a plant that are used to produce specific products for humans (e.g., sugar, dyes, paper, cloth, birch bark canoes/baskets, lumber, medicines, fruit, vegetables);

Describe various local and domestic plants used in food preparation (e.g., vegetables, fruits, spices, herbs) and identify places where they can be grown/found;

Describe various settings in which plant crops are grown (e.g., farms, orchards, home gardens, forest burn areas for blueberries/raspberries);

Describe ways in which plants and animals depend on each other (e.g., animals eat plants, animals fertilize plants, animals disperse seeds and pollen);

Compare the requirements of some plants and animals and identify the requirements that are common to all living things (water, air, energy);

Demonstrate awareness of ways of caring for plants properly (e.g., light, water, temperature, nutrients); and

Identify some functions of different plants in their local area (trees for shade/wind breaks/ bind soil, provide food/building materials).

LIFE SYSTEMS

Grade 4 - Habitats and Communities

Overview

Students in Grade 4 will be familiar with the basic needs of plants and animals, and will begin to explore and compare ways in which communities of plants and animals satisfy their needs in specific habitats. In their investigations, they will also study some of the factors that affect various habitats, including changes that occur naturally and changes brought about by people.

Big Idea

Habitats and communities are groups of interdependent plants and animals living together in order to survive.

General Learning Outcomes

By the end of Grade 4, students will:
Demonstrate an understanding of the concepts of habitat and community and identify some factors that could affect habitats and communities of plants and animals;

Investigate the dependency of plants and animals on their habitat and the interrelationships of the plants and animals living in a specific habitat; and

Describe ways in which humans can change habitats and the effects of these changes on the plants and animals within the habitats.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 4, students will:

Identify, through observation, various factors that affect plants and animals in specific habitat (e.g., availability of water, food sources, light, ground features, weather and seasonal conditions);

Classify organisms according to their role in a food chain (e.g., producer, consumer);

Demonstrate an understanding of a food chain as a system in which energy from the sun is transferred eventually to animals. Be able to construct food chains of different plant and animal species (egg, grass - arctic hare - fox), and classify animals as omnivore, carnivore, or herbivore;

Describe structural adaptations of plants and animals that demonstrate a response to their environment (e.g., the height of a plant depends on the amount of sunlight the plant gets; many animals that live in the Arctic have white camouflage);

Recognize that animals and plants live in specific habitats because they are dependent on those habitats and have adapted to them (e.g., duck/geese live in marshes because they provide food, water, shelter, and a place to nest); and

Classify plants and animals that students have observed in local habitats according to similarities and differences (bogs/swamps/marsh mosses and moose and barren grounds caribou).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 4, students will:
Formulate questions about and identify the needs of animals and plants in a particular habitat, and explore possible answers to these questions and ways of meeting these needs. Predict the structural adaptations that help plants/animals survive in their environment (e.g., do webbed feet help ducks and geese survive in a marsh? Do hooves help caribou move around the tundra? Do river otters, muskrat, beavers, or birch/pine/spruce trees share similar

characteristics);

Plan investigations for some of these answers and solutions, identify variables that need to be held constant to ensure a fair test, and identify criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terms, in describing their investigations, explorations, and observations (e.g., habitat, population, ecological niche, community, food chain);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, and labeled graphs produced by hand or with a computer (e.g., display data gathered in a population-simulation exercise, using a labeled graph; classify species of insects in the neighborhood according to habitat, using a chart or table); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences using electronic media, oral presentations, written notes and descriptions, drawings, pictograms and charts (e.g., prepare a poster illustrating the components of a local habitat; trace a food chain in an illustrated chart, using the sun as the starting point).

Relating Science and Technology to the World Outside the School

By the end of Grade 4, students will: Describe ways in which humans are dependent on plants and animals (e.g., for food products, medicine, heat, lumber, other building materials, and clothing (e.g., moose/caribou hides, cotton);

Describe ways in which humans can affect the natural world (e.g., over harvesting of wild populations, urban development, mines, pipelines, etc. forces some species to go elsewhere and enables other species left behind to multiply too rapidly or starve; conservation areas can be established to protect specific habitats, harvesting can be regulated or stopped for a specific length of time, laws and technology can be used to minimize impacts);

Construct food chains that include different plant and animal species and humans (e.g., moss – caribou – humans; aquatic plants – geese – humans);

Show the effects on plants and animals of the loss of their natural habitat (e.g., nesting sites for ducks can be destroyed if a road acts as a dam, global warming); and

Investigate ways in which the extinction of a plant or animal species affects the rest of the natural community and humans (e.g., chart the distribution of wolves or beluga whales on a world map and predict the effects if they were to become extinct. Use a software program such as Sim-Earth to simulate specific environmental effects and their projected consequences.

LIFE SYSTEMS

Grade 5 - Human Organ Systems

Overview

In Grade 5, study of the human body focuses on five major organ systems: the respiratory, circulatory, digestive, excretory, integument, and nervous systems. Using models and simulations, students will learn where the major internal organs are located and will explore the functions and interactions of organs within specific systems. In studying the structure of organs, students will learn that all living tissues are composed of different kinds of cells. Students will also develop an understanding of the importance of proper nutrition and exercise to the healthy functioning of organ systems.

Big Idea

The human body and its major organ systems are made up of specific cells, which have a specific form and function and require a well balanced diet to work properly.

General Learning Outcomes

By the end of Grade 5, students will: Demonstrate an understanding of the structure, form and function of the respiratory, circulatory, digestive, excretory, integument, and nervous systems, and the interactions of organs within each system; Investigate the structure, form and function of the major organs of the respiratory, circulatory, digestive, excretory, integument, and nervous systems; and

Demonstrate understanding of factors that contribute to good health and a healthy life style.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 5, students will: Identify the cell as the basic unit of life; Describe the basic structure, form and function of the major organs in the respiratory, circulatory, digestive, excretory, integument, and nervous system;

Describe using models and simulations, ways in which the skeletal, muscular, and nervous systems work together to produce movement (e.g., make a model of the bones and muscles in an arm, using cardboard rolls and elastic of bands);

Identify the skin as an organ and explain its purpose; and

Explain what happens to excess nutrients that are not immediately used by the body.

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 5, students will: Formulate questions about and identify the needs of humans, and explore possible answers to these questions and ways of meeting these needs (e.g., study the nervous system by investigating response times. This can be achieved by having someone drop a ruler between their thumb and index finger after it is dropped by another person);

Plan investigations for some of these answers and solutions, identify variables that need to be held constant to ensure a fair test and identify criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terms, in describing their investigations, explorations, and observations (e.g., use terms such as teeth, esophagus, stomach, and gastric

juices in describing the digestive system);
Compile data gathered through investigation in order to record and present results, using tally charts, tables and labeled graphs produced by hand or with a computer (e.g., record both qualitative/quantitative data from observations of the nutritional value of foods: produce a graph of the heart rate of various people running a specified length or given time); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences using electronic media, oral presentations, written notes, descriptions, drawings, and charts (e.g., comparing food groups from the Canada health guide).

Relating Science and Technology to the World Outside the School

Describe the types of nutrients in foods (carbohydrates, fats, proteins, vitamins, and minerals) and their function in maintaining healthy organs and a healthy body (e.g., supporting healthy growth);

Identify a balanced diet as one containing carbohydrates, fats, proteins, vitamins, minerals, fiber, and water and design a diet that contains all of these items;

Identify food sources (traditional and store bought) from which people can maintain a well balanced diet; and

Demonstrate that some disorders can be affected by diet (e.g., diabetes, heart disease/organ failure).

LIFE SYSTEMS

Grade 6 - Diversity of Living Things

Overview

The study of living things in Grade 6 focuses on the use of classification systems as ways of learning about the great diversity of species and as ways of organizing the study of species. Particular attention is given to the classification of organisms in the animal kingdom. Classifying animals not only will enable students to learn about many different types of animals, from mammals to microscopic organisms but also will help them to observe and describe similarities and differences among species more precisely. To acquire first-hand experience in studying the diversity of living things, students will examine and classify organisms in a specific habitat such as a lake, river, pond, swamp, forest or tundra.

Big Idea

Organisms can be classified according to their unique characteristics.

General Learning Outcomes

By the end of Grade 6, students will:
Demonstrate an understanding of ways in which classification systems are used to understand the diversity of living things and the interrelationships among living things;
Investigate classification systems and some of the processes of life common to all animals (e.g., growth, energy, reproduction, movement, response, and adaptation); and
Describe ways in which classification systems can be used in everyday life. Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 6, students will:
Explain why formal classification systems are usually based on structural character (e.g., type of skeleton, circulatory system, reproductive system) rather than on physical appearance or behavioural characteristics;

Recognize that the essential difference between cold and warm-blooded animals lies in different means of regulating body temperature;

Identify and describe the characteristics of vertebrates, and use these characteristics to classify vertebrates as mammals, birds, amphibians, reptiles, and fish (the five main classes);

Identify and describe the characteristics of invertebrates, and classify invertebrates into phyla (e.g., sponges, worms, mollusks, arthropods);

Compare the characteristics of vertebrates and invertebrates;

Compare the characteristics of different kinds of arthropods (crustaceans such as clams, and, snails; insects such as butterflies, mosquitoes, and, bees);

Describe microscopic living things using appropriate tools (hand lens) to assist them with their observations of pond life; and

Describe ways in which microorganisms, like larger creatures meet their basic needs (water, air, energy).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 6, students will:
Formulate questions about and identify the needs of different types of animals and explore possible answers to these questions and ways of meeting these needs (e.g., design an experiment to show whether

certain insects, such as stick bugs, will grow larger if given large quantities of food);

Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure fair testing and identifying criteria for assessing key solutions;

Use appropriate vocabulary, including correct science and technology terms, in describing their investigations and observations (e.g., use terms such as organism, species, structure, and kingdom/phyla in describing classification of animals);

Compile data gathered through investigation in order to record and present results, using charts, tables and labeled graphs produced by hand or with a computer (e.g., make an inventory of animals found in a specific location); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, oral presentations, written notes and descriptions, charts, graphs, and drawings (e.g., create a clearly labeled chart of organisms observed and identified during a pond study).

Relating Science and Technology to the World Outside the School

By the end of Grade 6, students will: Identify various kinds of classification systems, from a variety of sources, that are based on specific criteria and used to organize information (e.g., in a telephone system, numbers are classified according to country code, area code, telephone number, extension number);

Identify inherited characteristics (e.g., eye colour, hair colour) and learned or behavioural characteristics (e.g., habits of cleanliness);

Explain why characteristics related to physical appearance (e.g., size, shape, colour, texture) or behaviour are not suitable attributes for classifying living things;

Identify various kinds of plants and animal organism in a given plot using biological classification keys (e.g., organisms observed in a lake, pond or river, plants and animals found in or around the community);

Describe specific characteristics or adaptations that enable each group of vertebrates to live in its particular habitat (e.g., fish in lakes, birds in trees, moose around swamps) and explain the importance of maintaining that habitat for the survival of the species;

Explain how fossils provide evidence of changes in animals over geological time; and

Compare similarities and differences between fossils and animals of the present.

MATTER AND MATERIALS

In this strand, the study of matter in science is integrated with the use of materials in technology. In studying matter, students develop an understanding of the properties of substances, which will serve as a foundation for future theoretical studies in science. In designing and making useful objects, students apply their knowledge of the properties of the materials they are using, as well as knowledge of aesthetic and ergonomic principles in the area of technological design.

The topics covered in this strand are:

Kindergarten: Creating Colour

Grade 1: Characteristics of Objects and Properties of Materials

Grade 2: Properties of Liquids and Solids
Grade 3: Magnetic and Charged Materials
Grade 4: Materials That Transmit, Reflect, or Absorb Light or Sound

Grade 5: Properties of and Changes in Matter

Grade 6: Properties of Air and Characteristics of Flight

In their investigations and experimentation, students manipulate and observe materials and test them for their properties, as well as discuss the possible uses of these materials. At first, students report on their findings in qualitative terms, but as they learn to use mathematics, they will be able to express many of their observations in quantitative terms appropriate for their grade. Students also learn to see connections between science and technology and the broader social, cultural and economic context. For example, decisions to make a specific product may be based on such factors as economics, cultural values, environmental or waste considerations, and consumer values and demands.

In all grades, students develop the ability to use language to communicate clearly and to use science and technology terms appropriately. Many of the terms used in the study of matter and materials are ordinary words and students will be given the opportunity to learn their specialized meanings.

It is important that students follow established safety practices in all investigations. These practices include:

Following correct procedures when joining and shaping a variety of materials (e.g., always cutting materials away from oneself; firmly holding materials in place; avoiding the application of great force when using a tool as it can lead to loss of control of the tool or material; using scissors to cut masking tape; using a hand drill to make holes in wood; using a paper punch to make holes in paper);

Using tools, materials, and equipment safely;

Keeping tools and their work area clean; Returning materials, tools, utensils, and equipment to their proper places; Demonstrating concern for one's own safety and the safety of others (e.g., keeping sharp ends of objects such as needles and pins pointed away from oneself and others; tying back long hair and loose garments before approaching a heat source; never leaving a heat source unattended; using pot holders when handling hot utensils or pots; wearing safety goggles; reporting any damage to tools or equipment immediately); and Exercising caution when using the senses to explore substances (e.g., wafting smells toward the nose).

NOTES:

MATTER AND MATERIALS

Kindergarten – Creating Colour

Overview

In Kindergarten, students are introduced to the concept of creating colour. Through experimentation, students will investigate how the primary colour pigments can be used to create new colours. This will set the groundwork for their understanding of change and the interactions between substances to create new substances.

Big Idea

The primary colours can be used to create any new (secondary) colour.

General Learning Outcomes

By the end of Kindergarten, students will:
Recognize and list the primary colours; and
Create secondary colours by combining different primary colours.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Kindergarten, students will:

List the primary colours;

Collect and sort objects according to colours; and

Describe the process for creating secondary colour from primary colours.

Developing Skills of Inquiry, Design, and Communication

By the end of Kindergarten, students will:

Demonstrate how various primary colours can be used to create secondary colours consistently;

Design a picture that uses both primary and secondary colours and explain their choices;

Use appropriate vocabulary to describe colour (such as blue, yellow, light/dark, mixing); and

Ask questions about the possible outcomes that may result from colour blending and explore possible answers and solutions (e.g., blending colours by proportion to obtain consistent colours).

Relating Science and Technology to the World Outside the School

By the end of Kindergarten, students will:
Describe how the primary colours can be used to create colour in our life (e.g., painting houses/rooms); and

Identify specific coloured objects in our daily lives and justify why they are a specific colour (e.g., red/yellow fire trucks, white police cars, plant and animal coloration).

NOTES:

Matter and Materials

Grade 1 - Characteristics of Objects and Properties of Materials

Overview

In Grade 1, students are introduced to the concept of materials through exploration of various objects in their immediate surroundings. Students will use their senses to identify various materials and objects. In doing this, they will learn to make a clear distinction between objects and materials: they will learn that objects are made from materials and that materials have specific properties. They will also learn to describe these properties clearly and precisely. By making objects out of various materials they will begin to understand that there is a connection between the properties of materials and the specific purposes for which the materials are used.

Big Idea

Objects are made of materials with distinct characteristics intended for a specific purpose.

General Learning Outcomes

By the end of Grade 1, students will:

Distinguish between objects and materials (e.g., scissors are objects and they can be made of metal and/or plastic), and identify and describe the properties of some materials (e.g., flexibility of plastic, hardness of wood, malleability of metal);

Investigate the properties of materials and make appropriate use of materials when designing and making objects; and

Describe the function of specific materials in manufactured objects that they and others use in daily life.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 1, students will:
Demonstrate understanding of how senses help us recognize and use a variety of materials (e.g., our sense of sight enables us to determine whether the wood is sanded or rough; our sense of hearing tells us whether the machine is working or stopped);

Describe various materials using information gathered by using their senses (e.g., a piece of steel is hard, shiny, cold, and makes a ringing noise when tapped; a ceramic bowl is hard, rough-textured, and makes a dull sound when tapped);

Identify properties of materials that are important to the purpose and function of the objects that are made from them (e.g., the flexibility of plastic makes plastic wrap useful for covering food in order to keep it fresh; oil is slippery and useful as a lubricant); and

Describe using their observations, ways in which materials can be changed to alter their appearance, smell and texture (e.g., cooking changes the smell and texture of pizza or bannock; sanding and painting wood makes it smoother).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 1, students will:
Sort objects and describe the different materials from which those objects are made;

Demonstrate ways in which various materials can be manipulated to produce different sounds (e.g., produce sounds by tapping the sides of a glass that contain different amounts of water; beat different sizes of drums) and describe their findings;

Design a usable product (e.g., a drum, a tote bag, cookie, bannock, musical instrument) and construct it by combining and modifying

materials that they have selected themselves;

Ask questions about and identify needs and problems related to objects and materials, and explore possible answers and solutions (e.g., test materials to determine which ones insulate more efficiently; test different traditional and modern day manufactured/natural fabrics to determine which are waterproof);

Plan investigations to answer some of these questions or solve some of these problems;

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., use words such as soft, smooth, rough, sticky, natural, and manufactured when describing objects);

Record relevant observations, findings and measurements, using written language, drawings, charts, and concrete materials (e.g., make a display board and record the results of testing chalk on different materials); and

Communicate the procedures and results of investigations for specific purposes using demonstrations, drawings, and oral and written descriptions (e.g., display examples of materials tested and indicate which ones were best for writing on).

Relating Science and Technology to the World Outside the School

By the end of Grade 1, students will:

Describe how the properties of materials (e.g., sounds, textures, luster) help us learn about natural and manufactured objects;

Identify materials that can be used to join and fasten other materials (e.g., tape for paper, thread for buttons, rivets, glues, screws);

Demonstrate and list ways of reusing materials and objects in daily activities (e.g., reusing plastic containers at home and in school; reusing discarded materials);

Recognize and list objects made from materials that can be recycled (e.g., clothing, pop cans, plastic jugs, newspapers, other discarded materials);

Identify, through observation, the same materials in different objects (e.g., cotton shirts/towels, wood pencils/desks, glass windows/bottles, plastic cups/bottles, caribou/moose hide coats/boots);

Compare objects constructed for similar purposes (e.g., different types of chairs, boots, jackets) and identify similarities and differences between their corresponding parts and the materials from which they are made (e.g. metal, birch bark, fabric, hides); and

Identify materials commonly used in manufactured objects, as well as the source of those materials (e.g., wood/furniture, steel/axes, cotton/clothing, down/quilts).

MATTER AND MATERIALS

Grade 2 - Properties of Liquids and Solids

Overview

When students examine materials in the world around them, they become aware of a wide variety of similarities and differences in the properties of those materials such as, the way they look, feel, sound, or change. In Grade 2, students will develop their understanding of properties of materials through investigating liquid and solid materials. They will investigate ways in which solids and liquids interact, and will learn that some materials exist in both solid and liquid states. They will also learn that it is important to take into consideration the various properties of solids and liquids when designing and making objects.

Big Idea

The properties of liquids and solids are unique and interact with other liquids and solids in a variety of ways to produce materials.

General Learning Outcomes

By the end of Grade 2, students will:
Demonstrate an understanding of the properties (colour, viscosity, solubility, texture, smell) of familiar liquids (e.g., vinegar, detergent, water, oil) and solids (e.g., sugar, salt, sand), and of interactions between liquids and between liquids and solids;

Investigate the properties of and the interactions between liquids and between liquids and solids, and identify the types of objects or materials that can be used to contain liquids and solids (e.g., a plastic bowl will hold a liquid or a solid, but a paper towel will only hold a dry solid); and

Identify and describe ways in which we use our knowledge of liquids and solids in making useful objects.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 2, students will:
Describe the properties of liquids and solids, using their observations;

Distinguish between solids that dissolve in water (e.g., sugar) and solids that do not (e.g., sand);

Describe, using their observations, the characteristics of the three states of water, and identify the conditions that cause changes from one state to another (e.g., water turns to ice when placed in temperature below 0 C);

Recognize that the states of liquids and solids remain constant in some circumstances (e.g., solids remain solid when broken; liquids remain liquid when poured) but may change in other circumstances (e.g., liquids may freeze when the temperature drops; solids may melt when heated);

Identify reversible changes in materials (e.g., the changing of ice to water);
Identify, through observations, various substances that are buoyant (e.g., wood, oils);

Identify substances that can absorb another substance (e.g., paper towel absorbs water) and those that can dissolve another substance (e.g., water and sugar);

Describe instances where solids and liquids are mixed together to produce a colour change, gaseous product, form solid, liquid or dissolving effect; and

Evaluate the appropriateness of the materials chosen in the design and construction of a structure that is intended to float (e.g., polystyrene, paper, metal, wood, concrete).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 2, students will:

Design and assemble, using given materials, an object that is buoyant and able to support a given mass, and identify and describe the materials and tools they used;

Ask questions about and identify needs and problems related to the use of liquids and solids and explore possible answers and solutions (e.g., devise and explain a plan to build a model boat; predict changes that will occur when ice or water is heated or cooled);

Plan investigations to answer some of these questions or solve some of these problems, and describe the steps involved;

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., use such words as clear, runny and greasy when describing liquids and granular, hard and opaque when describing solids);

Record relevant observations, findings, and measurements, using written language, drawings, charts and concrete materials (e.g., record data from experimentation with liquids and solids on a chart; list characteristics of different liquids that they have observed); and

Communicate the procedures and results of investigations for specific purposes, using demonstrations, drawings, and oral and written descriptions (e.g., write a mini booklet describing class experiments in investigating liquids and solids).

Relating Science and Technology to the World Outside the School

By the end of Grade 2, students will:
Compare the properties of liquids with those of solids to determine which materials take the shape of their container (e.g., water will fill a container completely, but ice cubes will leave spaces);

Compare different materials with respect to their capacity to absorb, and identify ways in which this capacity determines how these materials are used (e.g., bond paper, paper towels, cotton, linen, wood, plastic);

Describe, using their observations, the behaviour of various liquids (e.g., water, oil) when poured on different surfaces (rough and smooth wood, cloth) when combined with solids (e.g., powdered milk) and when combined with other liquids (e.g., vinegar) and explain how the reactions they observe determine the uses of these liquids and solids;

Compare the properties of water with properties of at least one other liquid (e.g., detergent, vegetable oil, molasses);

Identify liquids used on the home and describe how they are used (e.g., milk for drinking and cooking, detergents for cleaning);

Describe using their own observations, some ways in which solids and liquids can be combined to make useful substances (e.g., flour, yeast, salt, shortening, and water make bread);

Identify objects in the immediate environment as solids (sand, ice, snow) or liquids (e.g., milk, water, vinegar); and

Recognize international symbols that give us information on the safety of substances (e.g., WHIMIS and Canadian Safety Council signage).

MATTER AND MATERIALS

Grade 3 - Magnetic and Charged Materials

Overview

In previous grades, students have manipulated, observed, and investigated a wide variety of materials. Now, they will focus on materials that are magnetic or those that can hold an electric charge. Students will investigate the ways in which different materials affect magnetic strength and electric charge. They will learn that every magnet has two poles, and that the strength of a magnet depends on the types and combinations of the various materials from which it is made. Students will also describe their observations of static electricity and the conditions that affect it. Through these investigations, students will increase their knowledge about the properties of materials that make them useful for specific purposes.

Note: Investigations with static electricity work best when the air is dry. On humid days, the moisture in the air reduces charge on a conductor.

Big Idea

The composition of a material will determine its magnetic strength and or its ability to hold, conduct or insulate an electrical charge.

General Learning Outcomes

By the end of Grade 3, students will:
Demonstrate an understanding of the properties of materials that can be magnetized or charged and how materials are affected by magnets or static electric charges;

Identify and describe, using their observations, ways in which static electric charges can be made using everyday materials, as well as different types of interactions that take place between charged and magnetized materials; and

Identify familiar uses of magnets and give examples of static electric charges that are created in the home or at school.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 3, students will:
Classify, using their observations, materials that are magnetic and not magnetic;

Identify materials that can be magnetized (e.g., iron, nickel, ceramics, composites);
Identify through observation, the effect of different conditions on the strength of magnets and on static electric charges in materials (e.g., the effect of distance between magnets; the effect of humidity on charged materials);

Compare different materials by measuring their relative magnetic strength or the strength of their electric charge (e.g., the number of paper clips that can be picked up by different sizes and types of magnets; the number of tissue paper bits that can be picked up by a charged comb);

Identify through observation, pairs of materials that produce a charge when rubbed together (e.g., glass and silk, wool, and hard rubber);

Describe and demonstrate how some materials that have been electrically charged or magnetized may either push or pull similar materials;

Determine through observation the polarity of the magnet (e.g., use a magnet of known polarity to test another magnet of known polarity);

Identify materials that can be placed between a magnet and an attracted object without diminishing the strength of the attraction (e.g., construction paper);

Predict, verify, and describe the interaction of two objects that are similarly charged (e.g., the interaction of two balloons after rubbing them on hair); and

Describe, through observation, changes in the force of attraction at different distances, both for magnetic forces and for static electric forces.

Developing Skills of Inquiry, Design, and Communication.

By the end of Grade 3, students will: Design and construct a system that uses magnetic force to move an object (e.g., create a boat that holds paper clips and move it through water using a magnet); Ask questions about and identify problems related to magnetic and static electric forces, and explore possible answers or solutions (e.g., investigate ways of producing static electric charges in different materials);

Plan investigations to answer some of these questions or solve problems, and explain the steps involved;

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., use terms such as north and south pole; attract and repel when describing magnets; and charge, dry, humid, conductor, and insulator when describing static electricity);

Record relevant observations, findings and measurements, using written language, drawings, charts, and graphs (e.g., use a data table to show the number of times a paper clip can be magnetized and the results of testing magnetic strength); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences using demonstrations, drawings, and simple electronic media, oral and written presentations (e.g., demonstrate how an object moves through a magnetic maze they have created).

Relating Science and Technology to the World Outside the School

By the end of Grade 3, students will:

Identify uses of magnets in familiar things (e.g., refrigerator magnets, magnetic cupboard latches, compasses);

Describe examples of static electricity encountered in everyday activities (e.g., cloth in a drier clinging together, wool socks on a carpet cause sparks, nylon snowsuits on plastic slides);

Identify ways in which static electricity can be used safely or avoided (e.g., “Swiffers” pick up dust; humidity and dryer sheets; grounding wires reduce static build up in a house/electrical system).

MATTER AND MATERIALS

Grade 4 - Materials That Transmit, Reflect, or Absorb Light or Sound

Overview

As students explore the properties of sound and light (see the Energy and Control strand for Grade 4), students will also encounter a wide variety of materials that transmit, reflect, or absorb energy. By focusing their investigations on the way these materials affect or are affected by sound and light, students will deepen their knowledge of the types of properties materials can have. They will also learn more about how the different properties of materials can help them to design products that are safe, useful, and creative.

Big Idea

Different materials can transmit, reflect, refract or absorb light and sound based on their properties.

General Learning Outcomes

By the end of Grade 4, students will: Demonstrate understanding that certain materials can transmit, reflect, refract or absorb light or sound;

Investigate materials that transmit, reflect, refract or absorb light or sound and use their findings in designing objects and choosing materials from which to construct them; and

Explain why materials that transmit, reflect, refract or absorb light and/or sound are used in a variety of consumer products.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 4, students will:

Recognize and describe how different materials affect light (e.g., water and prisms bend light as it passes through them; mirrors and polished metals reflect light);

Classify materials as transparent (e.g., glass, clear acrylic), translucent (e.g., frosted glass, white plastic shopping bags, tissue paper), or opaque (e.g., wood, metal); Demonstrate how opaque materials absorb light and thereby cast shadows;

Investigate, through explorations, ways in which different properties of materials, including their shape, affect the nature of sound (e.g., compare the sound produced by striking solid wood and hollow materials such as a drum);

Identify and describe, using their observations, physical changes (stretch or compression) in a material that can alter the sound it makes (e.g., the differences in sound when a loose rubber band and a stretched rubber band are plucked); and

Identify, using their observations, a variety of materials through which sound can travel (e.g., ringing a bell underwater, sending a message along a string can telephone).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 4, students will: Design and make instruments for a specific purpose or function (e.g., make magnifiers from glass jars half filled with water; make a drum from boxes or metal cans, wooden hoops or recycled plastic containers);

Formulate questions about and identify problems related to the ways in which materials transmit, reflect, refract or absorb sound or light, and explore possible answers or solutions (e.g., predict and verify the size shape, location, and type of materials for shadows and transmission from a given light source and the types of materials that will

make ringing sounds when struck);

Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terminology, in describing their investigations, explorations, and observations (e.g., use terms such as translucent, opaque, reflection, refraction, absorption, and conductivity to describe properties of materials in relation to light and sound);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, and labeled graphs produced by hand or with a computer (e.g., create a table to show the types of sounds made by hollow and solid objects, and the degree of translucence of objects, the degree of reflection/absorption of light by various objects); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using oral presentations, written notes and descriptions, drawings, and charts (e.g., create a shade chart of a selected colour, make a spinning colour wheel to demonstrate how "white" light is composed of all colours).

Relating Science and Technology to the World Outside the School

By the end of Grade 4, students will: Classify materials that transmit, absorb, or reflect energy from natural or human-made materials (e.g., wood, metal, clay, plastic, fabric, hides);

Identify transparent, translucent, and opaque materials used in objects in the immediate environment, and evaluate whether the ability of these materials to transmit, reflect, or absorb light enhances the objects' usefulness (e.g., usefulness of translucent white plastic shopping bags verses opaque paper shopping bags; use of coloured glass to preserve food and drink from light);

Describe, using their observations, how substances employed in finishing processes can alter a material's ability to transmit, absorb, refract or reflect light and sound (e.g., paint on wall, fabric curtains, frosted glass, shapes of rooms);

Describe and demonstrate using different materials, ways of mixing colours to create new colours (e.g., overlapping different colour acetates, mixing pigmented paints);

Compare the intensity of light passing through different materials and identify how the differences might determine the use of these materials;

Identify different types of light observed in the immediate environment and compare them with respect to colour, intensity and uses (e.g., fluorescent tube, incandescent light bulb, neon street light, rainbow, flashing store/sign light);

Compare materials in terms of the sounds that they can be made to produce (e.g., beating a drum, rubber bands plucked, tapping of different glasses, air blowing over a tube);

Investigate objects in the home and community that are designed and made to produce sounds (e.g., doorbells, telephones, microwaves, drums, fiddles, smoke detectors, etc.);

Describe some ways in which materials that absorb sound are used (e.g., acoustic tiles in community halls, theatres, gymnasiums, music rooms, ear plugs in loud sound areas); and

Describe practices that ensure their safety

and that of others when using light and sound (e.g., ear plugs when around loud noises such as hunting, music concerts, machinery, safety glasses; wearing sunglasses; not looking directly at strong light sources).

NOTES:

MATTER AND MATERIALS

Grade 5 - Properties of and Changes in Matter

Overview

In earlier grades, students have learned about the properties (such as strength, flexibility, buoyancy) of various materials and about how such properties determine what the materials are used for. Students now will begin to explore the underlying concept of matter. They will learn about the three states of matter (solid, liquid, gas) and the characteristics of each. They will also explore changes of state, and investigate the difference between physical changes (which are usually reversible) and chemical changes (which may not be reversible). Students will already know about many of these changes from their previous investigations, but now they will begin to apply their knowledge in a systematic way, using inquiry and design processes to solve problems and to choose appropriate materials for the devices they design and make.

Big Ideas

Materials can change physical state between solid, liquid, and gas depending on their properties and applications.

General Learning Outcomes

By the end of Grade 5, students will:
Demonstrate an understanding of the three states of matter (solid, liquid, gas) and of changes in state;

Investigate common changes of state (e.g., melting, freezing, condensing, evaporating) and make informed choices about materials when finding solutions to problems in designing and constructing objects based on their understanding of the states of matter; and

Identify the properties that make different materials useful in everyday products and discuss the environmental impact of their use.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 5, students will:
Identify and describe some changes to materials that are reversible and some that are not (e.g., freezing and melting are reversible; burning is not);

Describe changes they observe in the properties of materials as they interact with each other (e.g., when paints are mixed; when water is combined with gelatin, vegetable oil is mixed with water);

Describe examples of interactions between materials that result in the production of a gas (e.g., antacid tablets in water, baking soda in vinegar);

Identify the three different states of matter (solid, liquid, and gas) and give examples of each state (e.g., solid: sugar, rock; liquid: water, vegetable oil; gases: water vapour, air, oxygen);

Describe the characteristic properties of each of the three states of matter based on their properties (e.g., solids have definite shape and volume and hold their shape; liquids have definite volume but take the shape of their containers; gases have no definite volume and take the shape of their container);

Recognize, on the basis of their observations, that melting and evaporation

require heat;

Recognize melting, freezing, condensation, and evaporation as changes in state that can be reversed;

Describe, using observation, non reversible changes that occur when some materials are heated (e.g., when paper is burnt; when an egg is cooked); and

Investigate and describe the changes in the relative volume, shape, and temperature of materials when pressure is applied to them (e.g., the effects of using a hammer on clay or of sitting on a beach ball with the stopper removed).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 5, students will:
Design and make a device or product that minimizes heat loss (e.g., a coffee mug, a thermos flask, an insulated lunch bag, caribou/fur clothing);

Use a thermometer to measure the temperature of a material;

Conduct a fair test to determine the effectiveness of a variety of commercial and natural products designed for the same purpose (e.g., compare the insulation qualities of different types of commercial and natural insulations such as polar fleece, goose down and caribou hair);

Formulate questions about and identify needs and problems related to the properties and changes in the state of familiar materials and explore possible answers and solutions (e.g., estimate the length of time certain frozen foods take to thaw when heated; design a test to compare the insulating effects of different thicknesses of polystyrene foam or different furs/hides);

Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terms in describing their investigations and observations (e.g., use terms such as texture, hardness, strength, buoyancy, solubility, flexibility to describe properties and processes of materials);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, and labeled graphs produced by hand or with a computer (e.g., record the reaction of different materials when vinegar is dropped on them and use a data table to represent their findings); and

Communicate the procedures and results in investigations for specific purposes and to specific audiences using electronic media, oral presentations, written notes and descriptions, drawings and charts (e.g., make accurate and detailed drawings of sugar crystals, as seen by the unaided eye and under a microscope).

Relating Science and Technology to the World Outside the School

By the end of Grade 5, students will:
Identify the sources of natural and manufactured materials found in a product (e.g., plastic is made from petroleum products, down comes from ducks and geese) and describe the steps required to modify the natural materials to make the new product;

Describe how physical and chemical processes change materials found at home and materials used in industry (e.g., cooking, manufacturing plastic);

Describe physical changes and chemical reactions that can take place in household products and explain how these reactions affect the use of the products (e.g., the role

of baking soda, the role of heat in cooking an egg);

Measure, in different materials, observable changes that result from such processes as rusting, dissolving and bleaching and identify products that are affected by these processes (e.g., metal, powdered foods, fabrics);

Describe chemical changes that can be caused in a substance, and explain how the changes affect the use and function of the substance (e.g., changes caused by exposing newspaper or construction paper to light or heat; exposing an apple or potato to air);

Compare the mass of a substance in its liquid and solid states (e.g., compare the mass of ice cubes with the mass of the liquid that results when they are melted); and

Relate the mass of a whole object to the sum of the mass of its parts (e.g., measure a given amount of salt, the mass of a given amount of water and the mass of the container for the water, and compare the sum of those masses with the mass of the container and the mixture of salt and water; measure the separate masses of all the ingredients for a caribou stew and the pot, then compare the sum of the masses of the pot and the caribou stew. This can also be done with each component part required to make bannock).

NOTES:

MATTER AND MATERIALS

Grade 6 - Properties of Air and Characteristics of Flight

Overview

Students will continue to broaden their understanding of the gaseous state of matter by focusing on the properties of air. Through investigations, observations and experimentations, students will discover that gases such as air take up space, have mass, and expand when heated. In addition, students will learn that to a large degree, the ability to fly, of both living creatures and aircraft, depends on forces related to air pressure. As students investigate the properties of air, they will begin to understand how it can be a means to achieve lift, movement, and control in flying devices.

Big Idea

Air is a fluid and behaves according to Bernoulli's Principle.

General Learning Outcomes

By the end of Grade 6, students will:
Demonstrate an understanding of the properties of air (e.g., air and other gases have mass, are compressible, and have an undefined volume) and explain how these can be applied to the principles of flight;
Investigate the principles of flight and determine the effect of the properties of air on materials when designing and constructing flying devices; and

Identify design features (of products or structures) that make use of the properties of air, and give examples of technological innovations that have helped inventors to create or improve flying devices.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 6, students will:
Recognize that gravity does not depend on the presence of air;

Demonstrate understanding that gases expand to fill a space;

Demonstrate that air expands when heated (e.g., heat a garbage bag or dry cleaning bag partially filled with air using the heat from a blow dryer to heat the surface of the bag);

Demonstrate and explain how the shape of a surface over which air flows affects the role of lift (Bernoulli's Principle) in overcoming gravity (e.g., changing the shape or angle of an airplane's wings affects the air flow over it;

Demonstrate and describe methods used to increase lift or alter drag in flying devices (e.g., flaps on a aircraft's wings, wing slope, control surfaces, fuselage, tail, curvature of the wing);

Explain the importance of minimizing the mass of an object when designing devices to overcome the forces of earth's gravity;

Describe and demonstrate methods, which affect the lift of a wing (e.g., slats, flaps, spoilers);

Describe the sources of propulsion for flying devices (e.g., moving air, propellers, combustion of fuel in jet engines and rockets); and

Describe how unbalanced forces are used to steer airplanes and spacecraft (e.g., ailerons, elevators, rudder control an aircraft and rocket maneuvering thrusters maneuver a space craft).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 6, students will:
Design, construct and test a structure that can fly (e.g., a kite, a paper airplane, a hot air balloon);

Design and create a device that uses pneumatic power to move another object (e.g., balloon rocket);

Formulate questions about and identify needs and problems related to the properties of air and characteristics of flight and explore possible answers and solutions (e.g., investigate whether the shape of a plane affects its ability to fly);

Plan investigations from some of these answers and solutions, identifying variables that need to be held constant to ensure fair test and identifying criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terms, to communicate ideas, procedures, and results (e.g., use terms such as lift, thrust, drag, gravity, angle of attack, streamline, and aerodynamics when discussing flight);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, labeled graphs, and simple scatter plots produced by hand or computer (e.g., record the flight distances of different styles of paper airplanes, and present their findings in a graph); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, written notes and descriptions, charts, graphs, drawings and oral presentations (e.g., hold an invention convention where each student or group prepares a device that is capable of flight).

Relating Science and Technology to the World Outside the School

By the end of Grade 6, students will:
Identify devices that involve the application of Bernoulli's principle (e.g., paint sprayer, carburetor, aircraft wing);

Describe how the properties of air, such as its compressibility and insulating quality, are used in common products (e.g., automobile tires, double-glazed glass, down filled sleeping bags, fire extinguishers, traditional clothing/fur/hides down);

Describe and justify the differences in design between various types of flying devices (e.g., airplane versus helicopter, spacecraft versus hot-air balloon);

Identify characteristics and adaptations that enable birds and insects to fly;

Compare living things to identify the different features that allow them to be transported by wind (e.g., spores, pollen, seeds);

Describe milestones in the history of air and space travel;

Investigate and describe the impact flight and bush pilots have had on the development of Northern Canada;

Compare the different special features of different air transportation methods that enable those methods to meet different needs (e.g., small planes, turboprop/jet engines, passenger/cargo planes); and

Describe safe practices that ensure their safety and that of other during investigations into flight (e.g., safe practices at an airport or when using model planes).

ENERGY AND CONTROL

The Energy and Control strand introduces students to the concept of energy through concrete contexts and investigations, and gradually leads them to a more theoretical consideration of the topic. Some of the aspects of energy examined through concrete experiences include the common forms of energy, its conversions, and its uses. By experimenting with various devices that control the amount of energy dispensed, students will come to understand the relationship between energy consumption and energy conservation.

The topics covered in this strand are:

Kindergarten: Keeping Warm

Grade 1: Energy in Our Lives
Grade 2: Energy From Wind and Moving Water

Grade 3: Forces and Movement

Grade 4: Light and Sound Energy

Grade 5: Conservation of Energy

Grade 6: Electricity

As in other strands in the curriculum, investigation of energy begins with an examination of its most common forms, in contexts that are familiar to students, and gradually expands to include more complex forms and global contexts. The exploration of connections with the real world includes such topics as keeping warm, the wise use of energy, energy resources throughout the world, social, cultural and economic factors in energy generation, and consumer trends and preferences in energy use.

It is important that students follow established safety practices in all investigations. These practices include:

Operating safely, any appliances used in investigations related to energy (e.g., a hairdryer, an electric fan, sources of heat);

Incorporating appropriate safety features in devices or products they design and build by following safe practices;

Using all materials (e.g., elastics, springs, light bulbs, wire, sources of electricity) for their intended purpose;

Following the teacher's instructions during investigations that involve observation of the sun or forms of energy (e.g., never looking either at the sun directly or at reflections of its rays in a mirror; using forms of energy safely);

Using safely any device that enables one to study or produce sound, heat or light (e.g., tapes, microphones, portable cassette players, source of heat/light);

Using proper techniques in handling and disposing of materials;

Following safety procedures in investigations involving electricity; and

Using appropriate techniques in handling hot materials.

NOTES:

ENERGY AND CONTROL

Kindergarten - Keeping Warm

Overview

Keeping warm is an integral part of our daily activities. Students will investigate ways in which humans and other animals have developed methods for keeping warm. This awareness will help students understand and take responsibility for keeping warm.

Big Idea

Humans and other animals have devised ways of keeping warm.

General Learning Outcomes

By the end of Kindergarten, students will: Identify and explain methods of keeping warm and ways we keep warm throughout the seasons.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Kindergarten, students will: Identify appropriate clothing to wear for each season (indoor and outdoor);

Choose appropriate clothing based on environmental conditions; and

Explain ways in which people and animals keep warm.

Developing Skills of Inquiry, Design, and Communication

By the end of Kindergarten, students will: Ask questions about and identify the need for different clothing (traditional and synthetic) in response to environmental changes;

Compile a list of ways people keep warm in their home, when outdoors, on the land/bush camps and throughout the seasons, including sources of fuel and energy in a variety of settings;

Plan investigations to answer some of these questions and provide solutions to some of these problems;

Use appropriate vocabulary in describing their investigations, explorations and observations (e.g., heat, fuel, gas, oil, wood, electricity, clothing types);

Record relevant observations, findings and measurements using written language, drawings, concrete materials and charts (e.g., Create a mural/chart of different clothing worn during different season and activities; a chart of different sources of heat and where they come from and when they are used); and

Communicate the procedures and results of investigations and explorations for specific purposes, using demonstrations, drawings and oral and written descriptions (e.g., clothing wall charts, sources of heat).

Relating Science and Technology to the World Outside the School

By the end of Kindergarten, students will: Describe a variety of ways for keeping warm in different circumstances;

Identify devices that help keep us warm (inside and outside the house); and Identify outdoor clothing (traditional and synthetic) associated with the different seasons along with materials/designs used to make the product.

NOTES:

ENERGY AND CONTROL

Grade 1 - Energy in Our lives

Overview

Energy has many forms and is an integral part of our daily lives. Students need to become aware that they use many different forms of energy every day and that, as the agents who activate and control the source of energy, they are responsible for the amount of energy they consume. This awareness will help students develop a better understanding of the importance of monitoring their energy use. Students should also come to realize that all living things depend on some form of energy for survival.

Big Idea

All people use energy, in a variety of forms, daily to perform tasks.

General Learning Outcomes

By the end of Grade 1, students will:
Demonstrate an understanding of ways in which energy, in its many forms, is used in daily life;

Investigate some common devices and systems that use energy and ways in which these can be controlled manually; and

Describe different uses of energy at home, at school, and in the community, and suggest ways in which energy can be conserved.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 1, students will:
Recognize that the sun is the principal source of energy used on the surface of the earth;

Make connections to First People beliefs on the origin of the sun;

Identify food as a source of energy for themselves and other living things;

Identify everyday uses of energy (e.g., gas, oil, wood to heat our homes, electricity to cook our food and keeping warm); and

Recognize renewable and non-renewable sources of energy.

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 1, students will:
Construct a manually controlled device that performs a specific task (e.g., a folded fan; a tube to transport water to spin a water wheel; a trough to roll a ball down hill);
Operate a simple devise or system and identify the input and output (e.g., a hair dryer: input electricity/output is hot air; propane lights: input spark and gas, output, heat and light);

Ask questions about and identify needs and problems related to energy production or use in the immediate environment, and explore possible answers and solutions (e.g., discuss how people would cope with an electrical power failure by using alternate forms of heat and light);

What forms of energy are used when on the land or at bush camps;

Plan investigations to answer some of these questions or solve some of these problems;

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., use words such as

electricity, lights, energy, heat fuel, generator, oil, gas, wood stove);

Record relevant observations, findings, and measurements using written language, drawings, concrete materials, and charts (e.g., create an energy poster illustrating the various forms of energy used in daily life at home and on the land and how these forms of energy are used and controlled); and

Communicate the procedures and results of investigations and explorations for specific purposes, using demonstrations, drawings, and oral and written descriptions (e.g., prepare a chart of energy conservation devices and practices at home; prepare a chart illustrating different types of equipment used to do work, heat and light their home).

Relating Science and Technology to the World Outside the School

By the end of Grade 1, students will:
Describe the different forms of energy used in a variety of everyday devices (e.g., coiled springs in wind-up toys, wood in wood stoves, gasoline in snowmobiles);

Identify everyday devices that are controlled manually (e.g., a cassette recorder, lights, doorbells, toasters);

Identify devices they use inside and outside their house that consume energy (e.g., lights, computers, snowmobiles, cars, furnaces) and list things they can do to reduce energy consumption (e.g., turn lights out when leaving a room, use compact florescent lights, no idling of cars, turn thermostat down at night); and

Select one of the most common forms of energy used every day and predict the effect on their lives if it were no longer available.

ENERGY AND CONTROL

Grade 2 - Energy From Wind and Moving Water

Overview

The study of wind and water as sources of energy enables students to expand their understanding of different forms of energy and how they can be used. Through exploration and experimentation, students will actively investigate these two forms of energy. By designing their own wind and water propelled devices, students will learn to identify factors that affect the motion and control of such devices. The study of wind and moving water should also help students better understand the concept of energy. Integrating this aspect of the course with the Earth and Space Systems expectations for Grade 2 ("Air and Water in the Environment") will help students recognize the importance of air and water as two invaluable resources on earth.

Big Idea

Moving air and water are renewable forms of energy that can cause other objects to move.

General Learning Outcomes

By the end of Grade 2, students will: Demonstrate an understanding of the movement of air and water as sources of energy;

Design and construct devices that are propelled by moving air or moving water; and

Identify moving wind and water as renewable and recyclable sources of energy and determine the advantages and disadvantages of using them.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 2, students will:

Identify movement as an outcome of and energy input (e.g., fuel enables cars, trucks, ATV's snowmobiles and buses to move; electricity enables the fan in the kitchen to move; food provides humans with energy to move);

Recognize that it is the movement of air and water that produces energy and that air and water are not by themselves sources of energy; and

Identify various ways in which moving air and or water are used as a form of energy (e.g., hydroelectricity, tidal energy, wind turbines).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 2, students will: Design and construct a device propelled by air (e.g., kite, pinwheel, balloon rocket);

Design and construct a system that controls the flow of water and/or air using a variety of mechanisms (e.g., musical instruments, fountain valve, dam);

Ask questions about and identify needs and problems related to the use of wind and moving water as energy sources and explore possible answers and solutions (e.g., describe how moving water is used to produce electricity; describe how windmills were used historically to grind grain and pump water and now produce electricity);

Plan investigations to answer some of these questions or solve some of these problems and describe the steps involved;

Use appropriate vocabulary in describing their investigations, explorations and observations (e.g., use terms such as

renewable and movement when describing energy);

Record relevant observations, findings and measurements, using written language, pictures and charts (e.g., draw a diagram of their device; prepare a chart to present data on the distance traveled by their device over time); and

Communicate the procedures and results of investigations and explorations for specific purposes, using drawings, demonstrations, and oral and written descriptions (e.g., prepare a showcase of different devices that are propelled by wind energy (globally); explain the effect of wind direction and speed on the displacement of wind propelled devices).

Relating Science and Technology to the World Outside the School

By the end of Grade 2, students will:
Identify devices that use moving air and moving water as energy sources (e.g., windmills, water wheels, turbines), and describe what happens to these devices when the air or water is still;

List activities that are affected by moving water and wind (e.g., fishing, sailing, flying a plane, birds soaring on air currents);

Recognize that moving air and moving water can be sources of energy for electrical power; (e.g., use a small water generator to power a flashlight bulb);

Describe how gravity and the shape of different structures affect the behaviour and use of moving water (e.g., water in waterfalls, sink taps, fountains); and

Investigate hydro projects in the NWT: Talston, Snare and Bluefish Hydro projects.

ENERGY AND CONTROL

Grade 3 - Forces and Movement

Overview

The study of forces introduces students to two types of forces and their effects. The first type involves direct interaction, pushes and pulls between surfaces that are in direct contact. The second type, which includes magnetic and static electric forces, involves interaction at a distance, and students should be aware that these forces also exist. In exploring the effects of forces, students will learn about the ways in which forces create movement in objects due to an imbalance between forces, or the release of stored energy, such as the release of a wound spring. In addition, the study of forces will enable students to expand their understanding of control by designing and making devices that use a form of energy and can apply a force to another object. These activities will help students begin to recognize that all systems share certain characteristics such as systems made of component parts that work together to perform a specific task.

The study of the effects of magnetic and static electric forces can be related to the study of materials that can carry a charge or be magnetized. See the Matter and Materials expectations for Grade 3 ("Magnetic and Charged Materials").

Big Idea:

Movement is caused by an imbalance of forces due to the release of stored energy.

General Learning Outcomes

By the end of Grade 3, students will:
Demonstrate an understanding of how movement is caused by forces and by energy that is stored and then released to operate everyday devices;

Investigate how different forces affect the operation of everyday devices, and design and construct devices that use a form of energy to create controlled movement; and

Identify objects, devices, and systems in everyday life that are affected by forces and movement and explain in what ways they are useful to us.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 3, students will:
Identify force as a push or pull by one body on another;

Investigate the ways in which different forces (e.g., magnetism, static electricity, muscular force, gravitational force) can change the speed or direction of moving objects;

Investigate the effect of magnets and electrically charged objects on the motion of different materials (e.g., iron filings will be moved by a magnet but salt will not);

Identify, through observation, different forms of energy and suggest how they might be used to provide power to devices and create movement (e.g., the release of energy from a tightly wound rubber band or spring could create movement in a wind up toy);

Distinguish between the kind of motion and indicate whether the motion is caused indirectly (e.g., gravity, static electricity, magnets) or directly (e.g., by applied force); and

Investigate the effects of directional forces (e.g., left push for left movement) and how unbalanced forces can cause visible motion in objects that are capable of movement (e.g., an object pushed over a smooth floor; a sled over a frozen lake; a teeter totter).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 3, students will:

Ask questions about and identify needs and problems related to the behaviour of different forces in their immediate environment, and explore possible answers and solutions (e.g., identify everyday situations that produce static electricity and describe ways of removing static electricity from clothes; compare the strength of two magnets in holding layers of paper on a refrigerator door, or in picking up paper clips);

Plan investigations to answer some of these questions or solve some of these problems, and explain the steps involved (e.g., using different types and sizes of magnets; increasing or decreasing static charge; applying different amounts of forces to similar objects);

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., use terms such as push, pull, load, distance, speed when describing the effect of forces on an object, resistance field strength);

Record relevant observations, findings, and measurements, using written language, drawings, charts, and graphs (e.g., track a toy boat moving on water at various speeds, record the distances traveled, and present their findings on a chart);

Compare relative field strength of magnets (e.g., large vs. small and strong vs. weak) and the relative strength of elastic bands (e.g., large vs. small and long vs. short); Communicate the procedures and results of investigations for specific purposes and to specific audiences, using drawings, demonstrations, simple electronic media, and oral and written descriptions (e.g., give a demonstration showing how a device has been constructed and how it performs; make a drawing showing what alterations would be made to its design in the future; describe in writing the steps they used to build a device); and

Design and construct a device that uses a specific form of energy in order to move (e.g., a paper airplane propelled by hand or a rubber band).

Relating Science and Technology to the World Outside of School

By the end of Grade 3, students will: Describe the visible effects of forces acting on a variety of everyday objects (e.g., a toy goes forward when pushed; a ball falls down when dropped);

Identify surfaces that affect the movement of objects by increasing or decreasing friction (e.g., dry roads, icy roads, oils, rough/smooth surface textures, snow/ice/gravel);

Demonstrate how magnets work and identify ways in which magnets are useful (e.g., as metal detectors, magnetic locks on doors, maglev trains, picking up large and small metal objects, compasses);

Recognize devices that are controlled automatically (e.g., washers/dryers, furnaces), at a distance (e.g., remote control starts on vehicles, remote controlled cars) or by hand (e.g., flushing a toilet, refrigerator light, toaster); and

Identify parts of systems used in everyday life, and explain how these parts work together to perform a specific function (kitchen appliances such as a mixers, wind up toy, wind-up clock).

ENERGY AND CONTROL

Grade 4 - Light and Sound Energy

Overview

Building on their previous learning about different forms of energy and their sources, students now begin to examine in more depth two forms of energy they encounter on a daily basis: light and sound. Students will become familiar with the properties of light by investigating and observing how light interacts with various objects in the environment. From these observations, students will come to realize that light travels in a straight line, and they will begin to use this knowledge in constructing simple optical devices. Similarly, through investigations, students will learn how sound is created (by vibrations), how it travels, and how it can be sensed and measured. As well, by exploring the factors that affect the sounds that are produced, students will begin to discover ways in which sound can be controlled. To help students learn about the properties of light and sound, these expectations should be taught in conjunction with the Matter and Materials expectations for Grade 4 ("Materials That Transmit, Reflect, or Absorb Light or Sound").

Big Idea

Light and sound are produced and transmitted in different ways.

General Learning Outcomes

By the end of Grade 4, students will:
Demonstrate an understanding of the characteristics and properties of light and sound as they travel through a substance;
Investigate different ways in which light and sound are produced and transmitted, and design and make devices that use these forms of energy; and

Identify technological innovations related to light and sound energy and how they are used and controlled at home and in the community, and determine how our quality of life has been affected by these innovations.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 4, students will:

Identify a variety of natural and artificial light sources (e.g., the sun, a candle, different types of light bulbs, oil/gas lamps);

Describe the behaviour of light/sound, using observations, and identify some of its basic characteristics (e.g., they travel in a straight path, light bends as it passes from one medium to another, and reflects off shiny surfaces, sound must travel through a medium and bends around/reflects off objects);

Distinguish between objects that produce their own light and those that reflect light from another source (e.g., candles and the sun emit their own light; the moon reflects light from the sun; bike reflectors; dogs/cats/caribou eyes reflect light);

Identify through observation, colour as a property of light (e.g., use prisms, water in a jar, crystals in the window, water droplets on an overhead projector and show that white light can be separated into colours, ROY G BIV);

Predict the location, shape and size of a shadow when a light source is placed in a given location relative to an object;

Investigate and compare how light interacts with a variety of optical devices (e.g., kaleidoscopes, periscopes, telescopes magnifying glasses);

Recognize, using their observations that most luminescent objects give off both light and heat (e.g., the sun, a candle, a light

bulb), and identify some objects that give off light, but produce little or no heat (e.g., chemical light sticks, fireflies, arctic jelly fish, phosphorescent lichens);

Recognize, using their observations, that sound can travel through a substance (e.g., place a vibrating tuning fork in a shallow dish of water and describe what happens to the water; place rice on a drum and describe what happens to the rice when the drum is tapped or a tuning fork is place on the head of a drum);

Group a variety of sounds according to pitch and loudness and demonstrate how the sounds can be modified (e.g., drinking glasses filled with different levels of water);

Compare the range of sounds that humans can hear with the range of sounds that other animals can hear (e.g., dogs, bats, mice, lemmings, caribou, and whales, can hear different frequencies than humans);

Recognize that sounds are caused by vibrations of an object; and

Describe how the human ear is designed to detect vibrations (e.g., pinna, ear canal, ear drum, middle ear, inner ear; draw analogy to the ear drum and a musical drum).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 4, students will:
Formulate questions about and identify needs and problems related to their own experiences with light and sound, and explore possible answers and solutions (e.g., identify different sources and types of light and sounds in their environment);

Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessment;

Use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as source, artificial, beam of light, refraction, intensity of light, reflection in describing the behaviour of light; or pitch, loudness, vibrations in describing sounds);

Compile date gathering through investigations in order to record and present results, using tally charts, tables, and labeled graphs produced by hand or with the a computer (e.g., investigate different sources/types of light used in a house, school or out camping, create a sound diary to record the sounds encountered over a period of time);

Communicate the procedures and results of investigations for specific purposes and to specific audiences using electronic media, oral presentations written notes and descriptions, drawings and charts (e.g., draw diagrams showing the position of the light source and location of the shadow; create a chart showing how devices that rely on or produce light and sound contribute to user's quality of life);

Design, make and test an optical device (e.g., periscope, kaleidoscope);

Design and make musical instruments and explain the relationship between the sounds they make and their shapes (e.g., recorders, small/large drums, fiddles); and

Follow safe work procedures in all investigations (e.g., direct mirrors away from the sun to ensure that the sun's rays are not reflected into their eyes or the eyes of others; avoid producing excessive loud sounds).

Relating Science and Technology to the World Outside of School

By the end of Grade 4, student will:

Identify various uses of sounds encountered

daily, (e.g., warning sounds such alarms, microwave bells, school bells, car horns);

Describe the harmful effects of high noise levels and identify potential noise hazards at home or in the community (e.g., snow blowers, ATV's, chain saws, motor bikes, generators, airplanes);

Describe, using their observations, how sounds are produced in a variety of musical instruments (e.g., wind, string, percussion instruments) and identify those they like listening to best;

Identify sound related jobs (e.g., tuning pianos, musicians, song bird surveys, forensics, occupational sound specialist, medical technicians) and the role of sound in different jobs (e.g., the beep that warns us equipment is backing up; the noise of jackhammers as an occupational hazard; hunters shooting rifles);

Describe devices that extend our ability to see and hear (e.g., a telescope, a magnifying glass, an optical microscope, a hearing aid, a microphone or megaphone);

Identify different uses of light at home, at school, or in the community, and explain how their brightness and colour are related to their purpose (e.g., vivid neon lights are used for advertising; blue lights are used to identify snow-removal vehicles; dim lighting is used to create a soothing atmosphere in restaurants);

Describe the effect on the quality of life if light and sound could not be used as forms of energy;

Identify common phenomena related to light and sound (e.g., rainbows, shadows, echoes, sun dogs, shadows) and describe the conditions that create them;

Identify systems that use light or sound sensors to detect movement (e.g., motion detectors, check-out scanners, the eye, the ear, electronic tuners, automatic sink/faucet sensors, automated door openers).

NOTES:

ENERGY AND CONTROL

Grade 5 - Conservation of Energy

Overview

Modern society places large demands on non-renewable sources of energy. It is essential that the energy from these sources be used wisely. In addition, alternative and renewable sources of energy must be developed if we wish to sustain our present standard of living and ensure adequate energy supplies for future generations. Students need to understand the importance of this problem and learn how to conserve and use energy wisely. Building on their previous learning about mechanisms and systems, students will deepen their understanding of how devices use energy. By designing, constructing, and operating their own devices, they will learn how energy is transferred from one system to another. In addition, students will expand their knowledge of the different sources of energy and classify them as renewable and non-renewable.

Big Ideas

Energy conservation of both renewable and non-renewable resources is important for a sustainable future.

General Learning Outcomes

By the end of Grade 5, students will:
Demonstrate an understanding of the importance of conservation of energy in relation to the wise use of renewable and non-renewable energy sources;

Design and construct devices that use a form of energy to meet a specific need or want, and investigate how the energy is transferred to a specified output; and

Evaluate the reasons for conserving natural resources and identify possible ways of conserving and using energy wisely.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 5, students will:
Distinguish between a renewable and non-renewable source of energy; (renewable: wood, bio-fuels, wind, solar, geothermal, water; non-renewable oil, gas, coal);
Investigate ways energy can be stored for later use (e.g., mechanical energy is in an elastic band or steel spring; chemical energy is stored in a battery; potential energy is stored in water behind a dam);

Describe how energy is stored and transferred in a given device or system (e.g., in an automobile, chemical energy is stored in the gasoline and is transformed into mechanical energy upon combustion, enabling the vehicle to move and releasing thermal energy as heat and exhaust gasses);

Recognize that energy cannot be created or destroyed but can only be changed from one form into another (e.g., chemical energy in a battery can be converted to electrical energy);

Operate a mechanical devise or system that uses a sensory or time based input (e.g., a timer on a light; yard and street lights); and

Operate a mechanical device or system that uses a sensory or time based input (e.g., a timer on a light or car plug in) and describe how energy is transferred to a specified input.

Developing Skills of Inquiry, Design, and Communicate

By the end of Grade 5, students will:
Formulate questions about and identify needs and problems related to protection of the natural environment and explore

possible answers and solutions (e.g., investigate how local and home based recycling efforts help conserve energy and natural resources, such as selective harvesting of fire wood in a forest);

Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identify criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terms, in describing their investigations and observations (e.g., use terms such as heat, light, sound, electrical, mechanical, magnetic, chemical when describing forms of energy);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, and labeled graphs produced by hand or with a computer (e.g., list the names of some devices used in the home that change energy from one form into another, and record in a table the types of energy transformations for each device);

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, oral presentations, written notes and descriptions, drawings, and charts (e.g., use a word processor and graphics program to create a booklet about the design, construction, and effectiveness of a product that meets a specific need; debate the environmental implications of using various sources of energy); and

Design devices that can transform one form of energy into another (e.g., an electric to survive bell transforms electrical energy into sound energy).

Relating Science and Technology to the World Outside the School

By the end of Grade 5, students will:

List various sources of energy and identify them as renewable (e.g., sun, wind, tides, wood) or non-renewable (e.g., coal, natural gas, oil);

Describe the advantages and disadvantages of using renewable energy sources as opposed to non-renewable sources;

Identify the forms of energy (e.g., mechanical, electrical) used in the home, school, and community and identify the energy source for each (e.g., wood, coal, moving water);

Describe how we use different natural resources as sources of energy and evaluate the effect of their use on natural and human made environments (e.g., using fossil fuels such as natural gas for heating our homes we deplete natural resources, create greenhouse gases but improve our short term quality of life);

Explain the ways in which technological innovations affect our use of natural resources and increase or decrease our ability to conserve energy (e.g., home insulation allows us to conserve heat and reduce consumption of energy resources);

Identify factors that determine how effectively and economically a device can transform one form of energy into another (e.g., discuss the advantages and disadvantages of using solar panels for heating or electrical energy use ratings on appliances);

Explain how humans rely on energy transfers from a variety of products and systems to survive (e.g., chemical energy from food becomes muscular energy in humans; chemical energy from wood becomes heat/light energy when burned);

Identify ways humans use energy, evaluate the economic and environmental costs of each, and describe ways to avoid wasting energy (e.g., lowering the thermostat during the night; research energy ratings on types

of equipment);

Identify design features that improve the energy efficiency of buildings, devices and systems (e.g., double glaze windows; windows facing south, energy efficient furnaces and other new technologies).

NOTES:

ENERGY AND CONTROL

Grade 6 - Electricity

Overview

Electricity is a versatile form of energy that students encounter every day. Although students will already know about many of the uses of this convenient source of energy, they need to develop a deeper understanding of how it can be used to send signals. It is important for students to learn about this specialized area of study called electronics, which has made a major impact on our lives through many products and devices. Building on previous learning, students will explore devices that use tiny electric currents to switch electric circuits on and off, in order to understand how electronic systems are able to control very complicated processes automatically. As students expand their knowledge of the significant role electricity has in their lives, they should strengthen their awareness that they have control over the amount of electricity they use in the home and at school, as well as their awareness of the potential impact of the over-consumption of energy on our electricity supply.

Big Idea

Electrical energy can be transformed into other forms of energy.

General Learning Outcomes

By the end of Grade 6, students will:
Demonstrate understanding that electrical energy can be transformed into other forms of energy, such as heat, light, sound and mechanical energy;

Design and construct a variety of electrical circuits and investigate ways in which electrical energy is transformed into other forms of energy;

Identify uses of electricity in the home and community and evaluate the impact of these uses on both our quality of life and the environment.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 6, students will:
Investigate ways in which electrical energy can be transformed into other forms of energy (e.g., light, heat, and sound);
Compare the conductivity of a variety of solids and liquids;

Identify, through experimentation, ways in which chemical energy can be transformed into electrical energy (e.g., build a circuit using a lemon or a potato clock kit);

Compare the characteristics of current and static electricity;

Describe the relationship between electricity and magnetism in an electromagnetic device;

Identify, through observation, the effects of using different types of core materials in building an electromagnet; and

Identify different types of switches that are used to control electrical devices (e.g., contact, tilt switches, mercury thermostat switches) and explain the key differences among them (e.g., differences in design use).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 6, students will:
Formulate questions about and identify needs and problems related to the properties and uses of electrical energy and explore possible answers and solutions (e.g., compare some sources of electrical

energy used in the past, such as coal, wood, and seal oil, with sources of today, such as uranium, oil, gas, wind turbine and moving water, and evaluate the advantages and disadvantages of each;

Plan investigations for some of these answers and solutions, identify variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terms, in describing their investigations and observations (e.g., use terms such as current, battery, circuit, conductor, insulator; polarity, positive (plus) and negative (minus) charges for electrically charged materials; north pole and south pole for magnetic materials);

Compile data gathered through investigation in order to record and present results using tally charts, tables, labeled graphs and scatter plots produced by hand or with a computer (e.g., record in a journal all daily uses of electrical energy for a week, classify the various uses, and present the findings using tables and graphs);

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a diagram of an electrical circuit using appropriate symbols; create a brochure outlining safe and unsafe uses of electricity; create a table showing different factors that could lead to a decrease in consumption of electrical energy in the home and at school);

Design and build electrical circuits (e.g., series circuits and parallel circuits) and describe the function of their component parts (e.g., switches, power source);

Build and test an electrical circuit that performs a useful function, and draw a diagram of it using appropriate electrical symbols;

Construct series circuits and parallel circuits to control a device, and compare their characteristics; and

Design and construct an electrical system that operates a device in a controlled way (e.g., a switch provides a controlled input and lamps, buzzers or motors produce an output).

Relating Science and Technology to the World Outside the School

By the end of Grade 6, students will:
Identify sources of electricity and state whether the sources are renewable or non-renewable;

Recognize the uses of electromagnets in motors and generators;

Describe the electrical conversions in everyday devices to systems (e.g., electrical energy to heat energy in a toaster; electrical energy to mechanical energy in an electric mixer or drill);

Identify the different ways electricity is produced (e.g., by batteries using chemical energy; by dams using water; by generating station using diesel engines) and evaluate the effect of different production methods on natural resources and living things in the environment;

Describe conditions that could affect the consumption of electrical energy in the home and at school (e.g., seasonal variations in heat and light requirements; number of people in a house);

Identify devices that use electricity to send signals (e.g., televisions, telephones, radios, satellite phones, computers, am/fm, and communication radios);

Describe how electricity was discovered and

harnessed for use (e.g., name some inventions) and discuss whether we are more or less dependent on electricity than people in the past;

Develop a plan for reducing electricity consumption at home or at school and assess how this change could affect the economy (e.g., jobs) and our use of natural resources; and

Compare using tables and charts the cost of electricity in various NWT communities and their mode of generating electricity (e.g., Diesel at 35 cents kw/hr vs. hydro at 8 cents a kw/hr).

STRUCTURES AND MECHANISMS

The Structures and Mechanisms strand is largely technological in content. A structure is any form that resists forces that would cause it to change shape and size. A mechanism uses or creates motion and consists of one or several simple machines (e.g., lever, pulley, wheel) that perform a specific function. With successive grade levels, students gain greater sophistication in their understanding of structures and mechanisms, and skill in their ability to design and construct them. Students also learn that structures and mechanisms can be combined into a system, which is a set of connected parts whose action is controlled in specific ways such as, the brake system on a bicycle or car, or the electrical system in a house.

The topics covered in this strand are:
Kindergarten: Machines Around Us
Grade 1: Everyday Structures

Grade 2: Movement

Grade 3: Stability

Grade 4: Pulleys and Gears
Grade 5: Forces Acting on Structures and Mechanisms

Grade 6: Motion
Throughout this strand, students pursue many types of investigation that involve them in designing and building structures and mechanisms, and testing the results of their designs. Using their observations, students describe various kinds of forces and motion that affect their designs. In investigating the operation of systems, students identify the parts of a system and understand their function. They then use this knowledge to understand the operation of the system as a whole and to deal with problems and modifications relating to specific parts.

Students make links to the real world when they evaluate real examples of structures and mechanisms using not only performance criteria (e.g., strength) but also other criteria such as aesthetic, cultural/ergonomic qualities, cost of production, safety, and reliability. Students can make links to the Matter and Materials strand and the Energy and Control strand, as well as the social studies area of the curriculum (e.g., through consideration of structures designed by people in other cultures). Communication in this strand takes place through graphic design, demonstrations, and electronic media, as well as written and oral descriptions of structures and mechanisms.

It is important that students follow established safety practices in designing, constructing, and experimenting with structures and mechanisms. These practices include:

Using tools safely to cut, join, and shape objects;

Handling modeling clay correctly and washing one's hands after using it;

Following proper procedures when comparing mechanical systems and their operation; and

Using care when observing and working with objects in motion (e.g., objects that are spinning, swinging, bouncing, vibrating; gears and pulleys; elevated objects).

STRUCTURES AND MECHANISMS

Kindergarten - Machines Around Us

Overview

Students recognize that machines are all around us and we use or see them doing meaningful work daily. Students will investigate various machines used in their homes, at school, and around their community. They will develop/use a simple classification system to categorize different machines. Through observation and investigation students will see how machines can be used to make work easier.

Big Idea

Different machines are designed to do different jobs.

General Learning Outcomes

By the end of Kindergarten, students will: Demonstrate an understanding of the concept of a machine;

Describe the energy source required to make a machine work; and

Explain the specific uses of a machine.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Kindergarten, students will: Identify various machines in the house, school, and community;

Explain the purpose of a variety of machines; and

Explain the sources of energy required to run a machine (e.g., muscle power, gasoline/diesel engines, electrical motors).

Developing Skills of Inquiry, Design, and Communication

Design and make a simple machine to perform a task (e.g., a lever to move a weight, marbles rolling down a trough);

Ask questions about and identify the various types of machines in their home, school, and community;

Plan investigations to answer some of these questions or solve some of these problems;

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., bull dozer, fire and water truck, grader, washing machine, food processor etc.);

Record relevant observations, findings and measurements, using written language, drawings, charts and concrete materials (e.g., record the number of service vehicles in town, number of machines in the school, types of machines in a community); and

Communicate the procedures and results of investigations and explorations for specific purposes using demonstrations, drawings, oral and written descriptions (e.g., set up a pictorial display of machines, in the home, garage, workshop, construction site, community etc., and identify the uses of these machines).

Relating Science and Technology to the World Outside the School

By the end of Kindergarten, students will: List some appliances in the home, school and large machines found in the community; List some of the “monster” machines used by industry;

Explain the function/purpose of some machines (e.g., backhoe for digging, a food processor for mixing, a fire truck for fighting

fires, etc); and

Describe, using their own experiences, what machines are used for in their community.

STRUCTURES AND MECHANISMS

Grade 1 - Everyday Structures

Overview

Students are surrounded by a wide variety of objects and structures that have distinctive shapes, patterns, and purposes. There are also different categories of structures: solid structures like stone walls and concrete dams; frame structures like bridges and bicycles, and shell structures like domes and tents. By observing and manipulating different structures in natural and human-made environments, students in Grade 1 will begin to identify shapes that are repeated in various patterns, and shapes that are common to most structures.

Students will also be introduced to the concept of a system. In Grade 1, students will observe and use systems that they encounter in daily life and that involve a single input, which is the action required to set a system in operation (e.g., flicking a light switch), and a single output, which represents the response of the system.

Big Idea

Structures have form and function.

General Learning Outcomes

By the end of Grade 1, students will:
Demonstrate awareness that structures have distinctive characteristics;

Design and make structures that meet a specific need; and

Demonstrate understanding of the characteristics of different structures and of ways in which they are made, and recognize and use some systems in the home or at school.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 1, students will:

Explain the function of different structures (e.g., house, car, ATV, bridge, chair, umbrella, television, wheelbarrow, bicycle);

Identify ways in which various structures are similar to and different from others in form and function (e.g., rooms all have walls but are different in size and are used for different purposes; rubber balls are round and solid whereas balloons are round and hollow);

Classify various structures in their environment (e.g., fences, stairs, ladders, bridges, water tank rectangles) according to specific features (e.g., size, materials) and functions;

Identify geometric shapes (e.g., square, triangle, circle) in ordinary structures; and

Describe patterns that are produced by repetition of specific shapes or motifs in various materials and objects (e.g., the pattern formed by triangles in a bridge or by flowers on wallpaper).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 1, students will:

Design and make different structures using concrete materials, and explain the function of the structure (e.g., a box, a toy bridge, a slide for testing marbles);

Ask questions about and identify needs or problems related to structures in their immediate environment, and explore possible answers and solutions (e.g., make a box or a net in which to store a toy that has several pieces);

Plan investigations to answer some of these questions or solve some of these problems;

Use appropriate vocabulary in describing their investigations, explorations, and observations (e.g., use words such as triangle, tall, and zigzag in describing shapes; use input and output in describing the operation of a machine);

Record relevant observations, findings, and measurements, using written language, drawings, charts, and concrete materials (e.g., record the number of different basic shapes in a playground and draw them);

Communicate the procedures and results of investigations and explorations for specific purposes, using demonstrations, drawings, and oral and written descriptions (e.g., set up a display of different cooking utensils and identify the function of each utensil);

Use appropriate natural and manufactured materials to make structures (e.g., cut paper, mix sand and water, combine pipe cleaners, use molding clay);

Select appropriate tools and utensils (e.g., pencil, paintbrush, scissors, hacksaw, spoon, measuring cup), for a specific task; and

Use tools appropriately when joining and shaping various materials (e.g., nails, glue, sandpaper).

Relating Science and Technology to the World Outside the School

By the end of Grade 1, students will:
Distinguish between structures and devices made by humans (e.g., houses, toys, televisions) and structures found in nature (e.g., bird nests, honeycombs, beaver dams/lodges);

Explain the function of a structure that they have made and describe how they made it (e.g., a bridge, a castle, building block housing);

Identify structures whose function is indicated by their shape (e.g., stop sign, key, bicycle, air plane);

Examine different kinds of fasteners (e.g., tape, button, zipper, draw string, screws nuts/bolts/nails) and indicate where they are used;

Use and recognize the effects of different kinds of finishing techniques and processes (e.g., painting, colour, adding decals) on structures they have designed and made;

Recognize that a product is manufactured to meet a need (e.g., scissors for cutting, saws for cutting wood, snow mobiles, chain saw);

Identify the action (input) required to operate an everyday system (e.g., pressing a button to ring a doorbell), and identify the response (output) of that system (e.g., the ringing of a doorbell; switching lights on/off); and

Describe, using their own experiences, how the parts of some systems work together (e.g., wheels and axle; pulley and string; strings to pull cart).

STRUCTURES AND MECHANISMS

Grade 2 - Movement

Overview

The study of moving things helps children develop a sense of space, as well as an understanding of the relationship between stationary and moving objects, including themselves. Through observation and the use of specific vocabulary, students will develop the ability to describe the position and motion of objects. In exploring motion, students will investigate mechanisms, such as hinges, inclined planes, and wheels and axles plus identify the simple machine(s) within them, such as a lever, wedge, and or wheel. They will investigate how mechanisms that consist of one or more simple machines can change the type and the direction of the movement of an object; such as, a hinge (mechanism) makes use of a lever (simple machine) to move a door backwards and forwards.

Big Idea

Forces and simple machines can cause motion.

General Learning Outcomes

By the end of Grade 2, students will: Describe the position and movement of objects and demonstrate an understanding of how simple mechanisms enable an object to move;

Design and make simple mechanisms, and investigate their characteristics; and

Recognize that different mechanisms and systems move in different ways, and that the different types of movement determine the design and the method of production of these mechanisms and systems.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 2, students will: Describe different mechanisms through observation and investigation (e.g., hinge, inclined plane), and identify the components that are simple machines (e.g., lever, and wedge);

Describe, using their observations, the characteristics and movements of simple mechanisms (e.g., hinge, wheel, and axle);

Describe, using their observations, the position of an object in relation to other objects or to a specific area (e.g., use such words as over, under beside, behind);

Identify changes in the position of an object in relation to other objects (e.g., movement upward, to the left, downward, sideways); and

Describe, using their observations, the pattern of movement of objects (e.g., turning, spinning, swinging, bouncing, vibrating).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 2, students will:

Ask questions about and identify needs or problems related to structures and mechanisms and explore possible answers and solutions (e.g., investigate the effect of different floor coverings on the motion of a toy car);

Plan investigations to answer some of these questions or solve some of these problems and describe the steps involved;

Use appropriate investigations to answer some of these questions or solve some of these problems and describe the steps involved;

Use appropriate vocabulary to describe their investigations, explorations and observations (e.g., use words such as rotate, turn, faster and slower to describe the motion of wheels and axles);

Record relevant observations, findings, and measurements using written language, drawings and concrete materials (e.g., record what happens to the movement of a vehicle released from a ramp if the size of its wheels are changed);

Communicate the procedures and results of investigations and explorations for specific purposes, using drawings, demonstrations, and oral and written descriptions (e.g., draw a sketch of an object they plan to make and another sketch of the object after it is made; tell the class the procedures they followed in making a vehicle or a container with a hinged lid);

Make simple mechanisms and use them in building a device they have designed (e.g., vehicle with wheels and axles, ramp lever);

Select and use appropriate tools, utensils, and equipment (e.g., use a paper punch to make holes for the axle in cardboard wheels; use a leaver to move an object); and

Use appropriate techniques to make and fasten the components of a model that they have made (e.g., bend cardboard to make hinges; glue various materials together).

Relating Science and Technology to the World Outside the School

By the end of Grade 2, students will: Identify, through observation, the mechanical parts of objects (e.g., hinges on doors/boxes; wheel and axle of a toy car) and describe the motion of these parts; Compare the motion of objects on different surfaces (e.g., wheels of a toy on carpet, tile, and sand);

Compare the motion of similar objects made with or filled with different materials (e.g., ways in which baseballs and tennis balls bounce; ways in which film canisters containing different materials roll down a slope);

Describe, using their observations, the effect that different surfaces (e.g., wood, tiles, carpet, water) have on the rate at which an object moves or slows down;

Describe, using their observations, the effects of changing the slope of an inclined plane on the motion of an object that is placed on it (e.g., changes in speed, changes in distance traveled);

Predict factors that make a load easier or more difficult to move (e.g., the size of a wheel or hinge, the amount of friction);

Identify different ways in which wheels and axles can be attached to a chassis (e.g., by using an axle holder, by placing the axle in a hole drilled in the frame); and

Demonstrate awareness that the wheels of a vehicle rotate clockwise or counterclockwise depending on the direction of movement of the vehicle.

STRUCTURES AND MECHANISMS

Grade 3 - Stability

Overview

Students will develop their understanding of the concept of stability in structures and the function of specific mechanisms. They will design and build structures for a specific purpose that are rigid and strong, and will incorporate mechanisms in these structures. Students will also gain some understanding of the concept of balance and centre of gravity, which is a necessary foundation for the later study of equilibrium.

Big Idea

Stability of a structure depends on its design and construction materials.

General Learning Outcomes

By the end of Grade 3, students will:
Demonstrate an understanding of the factors that affect the stability of objects;

Design and make structures that include mechanisms that can support and move a load, and investigate the forces acting on them; and

Describe, using their observations, systems involving mechanisms and structures, and explain how these systems meet specific needs and how they have been made.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 3, students will:
Describe, using their observations, ways which the strength of different materials can be altered (e.g., folding increases the strength of paper);

Describe ways in which forces alter the shape or strength of different structures (e.g., a load may cause a cardboard box to buckle; compression can make some materials more rigid);

Describe ways to improve the strength and stability of a frame structure (e.g., use of triangles or a cross member);

Describe, using their observations, the role of struts (e.g., to resist compression) and ties (e.g., to resist tension) in structures under load (e.g., describe the effect of adding a strut to a wooden frame);

Describe, using their observations, the changes in the amount of effort needed to lift a specific load with a lever when the position of the fulcrum is changed; and

Describe the effects of different forces on specific structures and mechanisms (e.g., a structure collapse when the load is too heavy; a latch on a door handle opens when pressed).

Developing Skills of Inquiry, Design, and Communication

By the end of grade 3, students will:

Ask questions about and identify needs and problems related to structures and mechanisms in their immediate environment, and explore possible answers and solutions (e.g., investigate the effects of folding on the shape and strength of materials);

Plan investigations to answer some of these questions or solve some of these problems and explain the steps involved;

Use appropriate vocabulary to describe their investigations, explorations and observations (e.g., use terms such as fulcrum, load and effort when describing levers);

Record relevant observations, findings and

measurements, using written language, drawings, charts, and graphs (e.g., record the modifications they have made to increase the stability and strength of their structures);

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using demonstrations, drawings, simple electronic media, oral and written descriptions (e.g., make a mobile that illustrates their discoveries about balance);

Design and make a stable structure that will support a given mass and perform a specific function (e.g., a bridge, a photo frame);

Use appropriate materials to strengthen and stabilize structures that they have designed and made that are intended to support a load, such as a playground play centre (e.g., use gussets, struts, ties, buttresses);

Design and make a levered mechanism (e.g., a model of an animal whose legs are moved with a lever);

Design and make a stable structure that contains a mechanism and performs a function that meets a specific need (e.g., a drawbridge, a crane);

Use appropriate equipment and adhesives when making structures that they have designed themselves (e.g., transparent tape, low-temperature glue gun for wood); and

Use hand tools (e.g., hand saws, scissors) and equipment (e.g., templates, miter boxes) appropriately to cut a variety of materials (e.g., wood, paper, cardboard, plastic).

Relating Science and Technology to the World Outside the School

By the end of Grade 3, students will:
Distinguish between the structure of an object (e.g., the chassis of a vehicle) and its mechanical parts (e.g., the wheels and axles);

Recognize that geometrical patterns in a structure contribute to the strength and stability of that structure (e.g., a climbing frame);

Demonstrate awareness that the strength in structures is due to bulk (or mass), number of layers (e.g., layers in particle board) and shape (e.g., triangles, squares, cylinders);

Identify a number of common levers (e.g., crowbar, scissors, hammers, pliers, wheelbarrows, tweezers, tongs) and describe how they make work easier;

Identify efficient ways of joining the components of a mechanical structure or system (e.g., construct a right angle corner; use an axle at a right angle to a frame);

Describe, using their observations, how different balance points of different masses affect the stability of a structure; and

Predict which body position provides the most stability in various circumstances (e.g., standing with legs apart, lying on the ground).

STRUCTURES AND MECHANISMS

Grade 4 - Pulleys and Gears

Overview

In previous grades, students will have investigated and built structures using wheels and axles. In Grade 4, they will broaden their understanding by looking at two special kinds of wheels: pulleys and gears. Pulleys are used singly or in combination to move an object from one place to another. Gears can be used in combination to change speed and direction of movement. Students will design and build pulley systems and gear systems, and will explore the advantages of each type of system. They will also continue to refine their understanding of structures, and will incorporate mechanisms in a structure to meet a specific need.

Big Idea

Pulleys and gears transfer energy and direction of motion.

General Learning Outcomes

By the end of Grade 4, students will:
Demonstrate an understanding of the characteristics of pulleys and gears; Design and make pulley systems and gear systems, to investigate how motion is transferred from one system to another; and Identify ways in which different systems function, and appropriate criteria to be considered when designing and making such systems.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 4, students will:

Describe, using their observations, the functions of pulley systems and gear systems (e.g., they make changes in direction, speed, and force possible);

Describe, using their observations, how rotary motion in one system (e.g., a system of pulleys of different sizes) is transferred to rotary motion in another (e.g., a system of various gears) in the same structure;

Describe, using their observations, how gears operate in one plane (e.g., spur gears, idle gears) and in two planes (e.g., crown bevel, or worm gears); and

Demonstrate an awareness of the concept of mechanical advantage by using a variety of pulleys and gears.

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 4, students will:
Formulate questions about and identify needs and problems related to structures and mechanisms in their environment and explore possible answers and solutions (e.g., test the effort required by different gear or pulley system to lift the same load);

Plan investigations for some of these answers and solutions, identify variables that need to be held constant to ensure a fair test and identify criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terms, to describe their investigations (e.g., use terms such as block and tackle in describing pulley systems and gear train in describing gear systems);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, and labeled graphs produced by hand or with a computer (e.g., create a table recording how the action of a pulley system is altered by changing tension

of the band connecting two pulleys);
Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, written notes and descriptions, drawings, charts, and oral presentations (e.g., draw a diagram of a proposed object and a diagram of the finished product);

Design, make, and use a pulley system that performs a specific task (e.g., a pulley system that closes a door or carries an object from one place to another);

Design and make a system of pulleys and/or gears for a structure (e.g., a potter's wheel), that moves in a prescribed and controlled way, (e.g., fast, straight) and performs a specific function; and

Manipulate pliable and rigid materials (e.g., modeling clay, straws, string, wood) as required by a specific design task.

Relating Science and Technology to the World Outside the School

By the end of Grade 4, students will:
Demonstrate awareness that most mechanical systems are fixed and dependent on structures for support (e.g., elevator system);

Compare in qualitative terms the performance of various mechanical systems (e.g., a block-and-tackle system vs. a single-pulley system), and describe how and when they are used;

Identify and make modifications to their own pulley and gear systems to improve the way they move a load (e.g., change the size or number of pulleys or gears used; use gears that change direction through a right angle);

Evaluate in general terms (e.g., as more or less effective), the performance of a system that they have made and the performance of another system designed to do the same task;

Explain how various mechanisms on a bicycle function (e.g., levers for breaking, gears and a chain for changing speed);

Demonstrate awareness that finishing techniques can adversely affect the performance of a mechanical system (e.g., problems result if paint gets into a gear system; oil lubricate);

Identify the properties of materials (e.g., pliability, rigidity) that are best suited for use in a structure that contains a mechanical system;

Describe the consequences of having a limited choice of materials when making a device or a structure; and

Identify common devices and systems that incorporate pulleys (e.g., cloth lines, flag poles, cranes) and/or gears (e.g., bicycles, hand drills, wind-up clocks).

STRUCTURES AND MECHANISMS

Grade 5 - Forces Acting on Structures and Mechanisms

Overview

As students continue to design and build mechanical devices and structures, they develop a more sophisticated understanding of forces. Students in Grade 5 will identify the forces acting on and within structures, and will give simple quantitative descriptions of these forces. They will focus on ways of making mechanisms accomplish specific tasks with less effort.

Big Idea

Forces will affect different structures and devices in different ways.

General Learning Outcomes

By the end of Grade 5, students will:
Demonstrate an understanding of the effect of forces acting on different structures and mechanisms;

Design and make load-bearing structures and different mechanisms, and investigate the forces acting on them; and

Evaluate the design of systems that include structures and mechanisms, and identify modifications to improve their effectiveness.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 5, students will:
Identify and measure forces acting on a structure (e.g., mass, air pressure), and describe the effects of their application;
Identify the parts of a structure that are under tension and those that are under compression when subjected to a load (e.g., the wires in a suspension bridge are under tension; a ladder bearing a mass is under compression);

Compare qualitatively and quantitatively the force needed to lift a load manually with the force required to lift the load with a simple machine (e.g., lever, pulley system, gear system);

Describe, using their observations, the advantages and disadvantages of using different types of mechanical systems (e.g., a single pulley system has no mechanical advantage; a pulley system with two or more pulleys has a mechanical advantage);

Describe the turning force (torque) of different combinations of gears (e.g., the turning force of a higher gear and of a lower gear; and

Identify the force required by different pulley systems (systems with one or more pulleys) to move a load, and compare the systems in qualitative terms.

Developing Skills in Inquiry, Design, and Communication

By the end of Grade 5, students will:
Formulate questions about and identify needs and problems related to structures and mechanisms in the outdoor environment, and explore possible answers and solutions (e.g., construct a bridge that must support a given load across a given distance; determine which surface of a cantilever bridge or beam is under tension and which is under compression);

Plan investigations for some of these answers and solutions, identify variables that need to be held constant to ensure a fair test and identify criteria for assessing solutions;

Use appropriate vocabulary, including

correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as component, subsystem, and device when describing systems);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, and labeled graphs produced by hand or with a computer (e.g., make a chart to record data on the effort required to raise of a load with different pulley systems);

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, written notes and descriptions, drawings, charts, and oral presentations (e.g., give a presentation on the process of designing and making a specific structure);

Design and make a frame structure that can support a load (e.g., a bridge);

Make a mechanical system that performs a specific function (e.g., lifting a heavy load; retrieving an object from a position that cannot be reached by hand);

Cut, join, and rearrange pliable and rigid materials to make an object (e.g., cut cardboard at a 45 degree angle to make a miter joint; make a paper mache mould for a face mask); and

Describe safety measures to be taken to ensure their own safety and that of others (e.g., they need to check that fixed pulleys in pulley systems are secure before testing them).

Relating Science and Technology to the World Outside the School

By the end of Grade 5, students will: Identify specific considerations in actual manufacture of a product that they have designed and made (e.g., production time; cost and availability of materials);

Identify problems that arose in the designing and making of a product and indicate how these could have been avoided or how they were solved;

Describe the consequences of having limited time and materials when making a product;

Identify modifications intended to improve the performance, aesthetic appeal and impact on the environment of a product they designed;

Identify the aesthetic qualities of a product they made (e.g., form, colour, pattern, type of surface) and explain the usefulness of the product to others;

Assess the effect of modifying a component of a system (e.g., changing the size of tires, gears, etc., on a bicycle);

Assess the effect of modifying a subsystem that interacts with other subsystems within a system to perform a specific function (e.g., changing a pulley system to a lever system);

Describe how different mechanisms (e.g., ratchet and pawl, cam and cam follower) are designed for a specific purpose or function;

Recognize the advantages and disadvantages of using various mechanisms (e.g., levers, wheels and axles, pulleys, gears with respect to the amount of energy they require to move or lift a given load); and

Describe the changes in energy transfer that occurs when the number and size of gears in a gear system are modified (e.g., a mountain bike gear system).

STRUCTURES AND MECHANISMS

Grade 6 - Motion

Overview

In previous grades, students will have had many experiences observing different kinds of motion. Students in Grade 6 will learn to classify these kinds of motion as linear (e.g., a sliding door), rotational (e.g., a ferris wheel or carousel), reciprocating (e.g., a self-inking stamp), and oscillating (e.g., a swing). They will learn to analyze and predict the motion of objects, devices, and systems by understanding the forces that act on them and that determine the magnitude, speed, and direction of movement. Students will make different mechanisms that move in different ways, and will learn how mechanisms change one type of motion into another.

By observing the effects of motion, students will continue to develop their understanding of stability in systems. Students will also be introduced to the concept of kinetic energy.

Big Idea

Different kinds of motion can be used in machines to transfer energy and do work.

General Learning Outcomes

By the end of Grade 6, students will:
Demonstrate an understanding of different kinds of motion (linear, rotational, reciprocating, oscillating);

Design and make mechanical devices, and investigate how mechanisms change one type of motion into another and transfer energy from one form to another; and

Identify modifications to improve the design and method of production of systems that have mechanisms that move in different ways.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 6, students will:
Describe, using their observations, ways in which mechanical devices and systems produce a linear output from a rotary use input (e.g., screw, crank and slider, rack and pinion, cam and cam follower);

Describe, using their observations, the purposes or uses of three classes of simple levers (e.g., seesaw/first class, wheelbarrow/second class, tongs/third class);

Demonstrate an understanding of how linkages (systems of levers) transmit motion and force (e.g., by means of a fixed pivot, a moving pivot, and/or a fulcrum);

Demonstrate awareness that a moving mass has kinetic energy that can be transferred to a stationary object (e.g., a car hitting a parked car will cause the parked car to move);

Demonstrate awareness that friction (e.g., rubbing hands together/moving parts in a machine create heat due to friction) transforms kinetic energy into heat energy; and

Investigate ways of reducing friction (e.g., use a ball bearing, lubricants/special surfaces) so that an object can be moved more easily.

Developing Skills in Inquiry, Design and Communication

By the end of Grade 6, students will:
Design and make mechanical devices that change the direction and speed of an input to produce a desired output and that perform

a useful function (e.g., a clothesline, simple piston pump);

Formulate questions about and identify needs and problems related to structures and mechanisms in the environment, and explore possible answers and solutions (e.g., describe how a system, such as a simple plumbing system, could be modified to meet different needs);

Plan investigations for some of these variables that need to be held constant to ensure a fair test and identify criteria for assessment solutions;

Use appropriate vocabulary, including correct science and technology terms in describing their investigation and observations (e.g., such as fulcrum, pivot, rack and pinion, belt, lubricant, friction);

Compile data gathered through investigation in order to record and present results, using tally charts, tables labeled graphs, and simpler scatter plots produced by hand or with a computer (e.g., measure and record the motion of moving objects; manipulate forces on computerized simulations of data collected from a moving object); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, written notes and descriptions, charts, drawings, and oral presentations (e.g., describe how a product was created from the first idea to the final model; produce a set of instructions to control the sequence of movements of a simple mechanical device such as a window opener).

Relating Science and Technology to the World Outside the School

By the end of Grade 6, students will:
Make use of the physical and aesthetic properties of natural and manufactured materials when designing a product;

Show awareness of the effect on a design of the unavailability of specific materials (e.g., the design of a pair of scissors may need to change if only plastic is available instead of metal);

Write a plan outlining the different materials and processes involved in producing a product (e.g., resources, equipment, marketing);

Identify various criteria for selecting a product (e.g., safety, reliability, durability);

Describe modifications that could improve the action of a variety of devices in the home (e.g., can-opener, nutcracker, clothesline on pulleys);

Show an understanding of the impact of moving mechanisms (e.g., truck, trains, planes, snowmobiles, ATV's) on the environment and on living things (e.g., loss of natural habitat; pollution);

Compare qualitatively the efforts required to move a load a given distance using different devices and systems; and

Describe how different devices and systems have been used by different cultures to meet similar needs (e.g., irrigation systems for farms, temporary shelters, bicycles, wagons and carts).

EARTH AND SPACE SYSTEMS

The Earth and Space Systems strand deals with the science and technology of our planet and of space. As with other strands in the curriculum, students begin with aspects of the topic that are most familiar to them, dinosaurs, the cycles of the days and seasons, the local soil and rocks, the particular features of their region, weather, the observable constellations in the night
sky and progress towards those with which they are less familiar or that are more complex.

The topics covered in this strand are:

Kindergarten: Dinosaurs

Grade 1: Daily and Seasonal Cycles

Grade 2: Air and Water in the Environment

Grade 3: Soils in the Environment

Grade 4: Rocks, Minerals, and Erosion

Grade 5: Weather

Grade 6: Space

As the above list of topics indicates, the material covered in this strand naturally leads students to the process of observation and exploration. Investigations will be numerous and varied, and should be of particular interest to students since many of the topics deal with things and events that students have often observed and wondered about. Links with the world beyond the classroom also arise naturally since most of the topics studied in the strand relate to the world outside. Students will have many opportunities to explore the environment, the use and misuse of resources, and the
impact of space technology on our knowledge of the earth, and the exploration of space.

It is important that students follow established safety practices in all investigations. These practices include:

Washing one's hands after handling soil samples and other Earth materials;

Covering rock samples and wearing safety goggles when chipping;

Waiting for instructions in fieldwork before proceeding; and

Following specific instructions during investigations such as never looking directly at the sun or work outside during an electrical storm).

NOTES:

EARTH AND SPACE SYSTEMS

Kindergarten

Dinosaurs

Overview

Dinosaurs have been extinct for about the past 65 million years and we have a great fascination with and about these diverse creatures. Throughout this unit students will explore the world of dinosaurs to gain a better understanding of species diversity, evolution and where the animals of today came form. Students will discover that the fossil record is like a puzzle, which provides insight into the biological history of earth. Through investigations students will be able to speculate about dinosaur characteristics, based on their physical characteristics.

Big Idea

Fossils tell us about the characteristics of dinosaurs.

General Learning Outcomes

Investigate representative types of dinosaurs that lived on the land, water, and in the air over 65 million years ago.

Specific Learning Outcomes

Understanding Basic concepts

By the end of Kindergarten, students will:
Describe some of the physical characteristics of representative dinosaurs;
Demonstrate an understanding that dinosaurs lived millions of years ago and are now extinct; and

Identify a dinosaur as a carnivore or herbivore and what habitat they may have lived in, based on its physical characteristics.

Developing Skills of Inquiry, Design, and Communication

By the end of Kindergarten, students will:
Construct models of dinosaurs, using modeling clay, to demonstrate some of the basic characteristics of representative dinosaurs;

Use appropriate terminology to describe dinosaurs;

Make impressions of fossils using modeling clay; and

Communicate the procedures and results of explorations and investigations using demonstrations, drawings, oral and written descriptions (e.g., make a dinosaur card catalogue of physical and or behavioural attributes to sort carnivores, herbivores, omnivores or land, air or water creatures).

Relating Science and Technology to the World Outside the School

By the end of Kindergarten, students will:
Identify areas in the NWT and Canada where fossils can be found;

Compare the characteristics of the modern day descendents of dinosaurs with the dinosaurs that lived over 65 million years ago; and

Investigate the different professionals that enhance our understanding of how and what type of animals lived long ago.

NOTES:

EARTH AND SPACE SYSTEMS Grade

1 - Daily and Seasonal Cycles

Overview

In observing their environment, students become aware of changes that take place in it, including changes in physical factors such as temperature, wind, and light, and changes in plants and animals. Through observation and investigation, students will learn that changes often occur in predictable cycles, including the relatively short cycle of day and night and the longer cycle of the seasons. Recognizing these cyclical patterns prepares students to discover relationships among events in their environment, and between the environment and themselves.

Big Idea:

Daily and season cycles affect all living things.

General Learning Outcomes

By the end of Grade 1, students will:
Demonstrate an understanding of changes that occur in daily and seasonal cycles and of how these changes affect the characteristics, behaviour, and location of living things;

Investigate changes that occur in a daily cycle and in a seasonal cycle; and

Describe how living things, including humans, adapt to and prepare for daily and seasonal changes.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 1, students will:

Identify the sun as a source of heat and light;

Compare the different characteristics of the four seasons (e.g., length of day, type of precipitation);

Use units of time related to the Earth's cycles (e.g., days, months, seasons); and Describe, using their observations, changes in heat and light from the sun over a period of time (e.g., measure and describe outdoor temperature changes at different times of the day; observe and describe how the position of the sun influences the length and shape of shadows).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 1, students will:
Design and construct models of structures that would provide protection against local weather conditions (e.g., bus shelters, houses, tents, igloos);

Ask questions about and identify needs or problems arising from observable events in the environment and explore possible answers and solutions (e.g., chart observations of a sunflower over several days and identify a pattern in the movement of the head of the flower; record sunrise times and sunset times as observable patterns);

Plan investigations to answer some of these questions or solve some of these problems;

Use appropriate vocabulary in describing their explorations, investigations, and observations;

Record relevant observations, findings, and measurements, using written language, drawings, concrete materials, and charts (e.g., draw pictures of how animals live and what they do at different times the year; measure and record changes in temperature); and

Communicate the procedures and results of explorations and investigations for specific purposes, using demonstrations, drawings, and oral and written descriptions (e.g., write and illustrate a booklet about their observations of seasonal changes; keep a journal/pictographs recording and describing the weather for a given period of time).

Relating Science and Technology to the World Outside the School

By the end of Grade 1, students will: Identify outdoor human activities that are based on the seasons (e.g., swimming, gardening, skating, hunting, fishing, berry picking) and examine some of the solutions humans have found to make it possible to engage in these activities out of season
(e.g., community and sports centers make it possible to swim and skate in any season; greenhouses make it possible to garden in any season, ice drill for winter fishing);

Identify characteristics of clothing worn in different seasons and make appropriate decisions about clothing for different environmental conditions;

Identify features of houses that help keep us sheltered and comfortable throughout daily and seasonal cycles (e.g., lights, furnaces/woodstove);

Describe changes in the characteristics and behaviour of living things that occur on a daily basis (e.g., their own daily routines at school and at home, the behaviour of nocturnal animals, changes in certain plants and flowers);

Describe the changes in the characteristic behaviour, and location of living things that occur in seasonal cycles (e.g., trees shed their leaves, birds and fish migrate); and

Describe ways in which humans modify their behaviour to adapt to changes in temperature and sunlight during the day
(e.g., one puts on extra clothes when it gets cooler, wearing sunglasses).

EARTH AND SPACE SYSTEMS
Grade 2 - Air and Water in the Environment

Overview

Air and water form a major part of the physical environment and are essential materials for life, yet our awareness of them is often limited largely because we recognize them only in their most obvious and observable forms (e.g., water in lakes and rivers, rain, wind). Through investigations, students will learn about the characteristics of air and the various forms of water in the environment, about changes in and interactions between air and water when they are heated and cooled, and about their movement through the environment. In the process, students will discover the many ways in which air and water contribute to the health and survival of living things, including ourselves.

Big Idea:

All living things need water and “air” to survive.

General Learning Outcomes

By the end of Grade 2, students will:
Demonstrate an awareness of the forms in which water and air are present in the environment, and describe ways in which living things are affected by water and air;
Investigate the visible effects of air and water in the environment; and

Describe ways in which clean air and water are vital for meeting the needs of humans and other living things.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 2, students will:
Demonstrate an awareness of air as a substance that surrounds us and takes up space, and whose movement we feel as wind;

Describe the movement of air relying on their observations of its effects (e.g., tree branches swaying, clouds moving, blowing snow or dust);

Compare characteristics of and changes in observed air conditions, in both indoor and outdoor environments (e.g., cold winter temperatures outdoors and warm temperatures indoors);

Identify ways in which changes in temperature affect living things, including themselves (e.g., decisions concerning activities or transportation, hibernation, dormancy, and migration);

Recognize that water exists in three states on Earth (e.g., solid (ice); liquid (rain); gas (water vapour);

Identify and describe forms of moisture in the environment (e.g., dew, snow, fog, frost, rain, hail);

Identify the factors that cause things to dry quickly or slowly (e.g., air temperature; amount of moisture in the air; amount of wind); and

Recognize evidence of the water cycle (e.g., observe water in a closed container and water in an open container; observe snow evaporating or melting).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 2, students will:

Ask questions about and identify needs or problems arising from events in the outdoor environment, and explore possible answers

and solutions (e.g., observe that there is a relationship between the patterns and movement of clouds and changes in weather; monitor the length of time needed for various clothing to dry in order to determine which materials are more suitable for wet weather);

Plan investigations to answer some of these questions or solve some of these problems, and describe the steps involved;

Use appropriate vocabulary in describing their explorations, investigations, and observations (e.g., use words such as solid, liquid, vapour; use the correct terms to describe quantities of water in standard
(metric) and non-standard units of measure: none, a little, a lot);

Record relevant observations, findings, and measurements, using written language, drawings, concrete materials, and charts (e.g., record and graph weather data gathered over a period of a few weeks); and

Communicate the procedures and results of explorations and investigations for specific purposes, using drawings, demonstrations, and oral and written descriptions (e.g., write the instructions for constructing a pinwheel, adding helpful drawings or diagrams).

Relating Science and Technology to the World Outside the School

By the end of Grade 2, students will: Predict and describe how local weather conditions affect living things, including themselves (e.g., effect of wind on trees in
autumn, effect of snowfall on humans' ability to travel, too much sunlight);

Describe the different uses of water and identify some that are essential for maintaining our health (e.g., water is used for drinking and washing; clean drinking water is essential for the health of humans);

Identify sources of drinking water locally (e.g., lakes and rivers);

Recognize that clean water is an increasingly scarce resource in many parts of the world and that the water we use is part of our environment and should be used wisely (e.g., taps should be turned off while brushing teeth; toxic substances such as oil, paints etc., should not be poured down the drain); and

Demonstrate an awareness of the ways in which the disposal of water can affect our health and the health of other living things (e.g., pouring waste water containing chemicals into oceans, lakes or rivers can seriously harm people and the organisms in the water).

EARTH AND SPACE SYSTEMS

Grade 3 - Soils in the Environment

Overview

As children soon discover, soil is not just dirt but a rich source of life and nourishment for many organisms, including humans. Many different kinds of animals and plants live in soil, which provides a base for gardens, forests, fields, and farms. By examining soils, students will discover that soils are made up of living things and different Earth materials. Different kinds of soil have different characteristics and combinations of materials, which determine their animal and plant populations as well as their suitability for particular uses. Students' investigations in this strand will involve manipulation as well as observation and other methods of inquiry.

Big Idea:

Soils have many different characteristics and stability based on its characteristics.

General Learning Outcomes

By the end of Grade 3, students will:
Demonstrate an understanding of the similarities and differences between various soils and the effects of moving water on soils;

Investigate the components of various soils, and describe the effects of moving water on these soils; and

Recognize the dependence of humans and other living things on soil and recognize its importance as a source of materials for making useful objects.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 3, students will:
Describe, using their observations, the various components within a sample of soil (e.g., pebbles, decaying plants, sand, clay, humus);

Describe, using their observations, the differences between sand, clay, humus, and other soil components (e.g., texture, smell, malleability), and compare and describe soil samples from different locations (e.g., school yard, forest, marsh, beach, bog, tundra, river bank);

Compare the absorption of water by different Earth materials, and describe the effects of moisture on characteristics of the materials (e.g., on texture, coherence, ability to hold a shape);

Describe, using their observations, how different Earth materials (e.g., rocks, pebbles, sand, humus, and clay) are affected by moving water (e.g., the sand on a beach washed by waves; pebbles in a river, water running over/through top soil);

Compare the different ways in which plant roots (e.g., fibrous roots, tap roots) grow through the soil; and

Describe, through experimentation, how soil can be separated into different components (e.g., sieving, sedimentation jar).
Developing Skills of Inquiry, Design, and Communication

By the end of Grade 3, students will:

Ask questions about organisms and events in the outdoor environment and identify needs of organisms that arise from these events, and explore possible answers to these questions and ways of meeting these needs (e.g., investigate the different effects produced when water is sprayed on and poured on exposed soil, asphalt and grass, different soil types);

Plan investigations to answer some of these questions or find ways of meeting these needs, and explain the steps involved;

Use appropriate vocabulary in describing their investigations, explorations and observations (e.g., use terms such as clay, sand and pebbles to describe the earth materials in soil; large, small, very small particles);

Record relevant observations, findings and measurements, using written language, charts and drawings (e.g., create a tally chart to record absorption of different Earth/soil type materials); and

Communicate the procedures and results in investigations for specific purposes and to specific audiences using drawings, demonstrations, simple electronic media, and oral and written descriptions (e.g., record what happens when soil and water are shaken together in a sediment jar; prepare a display comparing the composition of soils from different locations).
Relating Science and Technology to the World Outside the School

By the end of Grade 3, students will: Identify living things found in the soil (roots, larvae, microorganisms);

Demonstrate awareness of the importance of recycling organic materials in soils (e.g., explain the purpose of a compost heap; explain the reason why it is useful to leave grass clippings on the lawn; keep natural materials on the forest floor e.g., caribou antlers);

Recognize the importance of understanding different types of soil and their characteristics (e.g., soil types determine which plants will grow and which animals will live in that habitat; enables people to determine which crops can be grown in a particular area; enables gardeners and farmers to improve plant growth);

Describe how the use of different soils affects the growth of indoor plants; and

Describe ways of using soil materials to make useful objects and investigate, through manipulation, ways of shaping clay to make useful objects (e.g., model bricks, beads, pots).

EARTH AND SPACE SYSTEMS

Grade 4 - Rocks, Minerals, and Erosion

Overview

The study of rocks and minerals introduces students to geology. By examining different types of rocks and minerals found in the Earth's crust, students will learn about their characteristics and properties. They will also discover that rocks and minerals are useful for many things and that those characteristics help to determine their use. Through an examination of the processes of erosion, transportation, and deposition, students will develop an understanding of the changing landscape and of the ways in which wind, water, and ice reshape it. The examination of these processes will lead to an exploration of the ways in which humans can both prevent changes to the landscape and adapt to these changes.

Big Idea

Rocks and minerals have unique characteristics and the landscape is affected by erosion.

General Learning Outcomes

By the end of Grade 4, students will:
Demonstrate an understanding of the physical properties of rocks and minerals and the effects of erosion on the landscape;
Investigate, test, and compare the physical properties of rocks and minerals and investigate the factors that cause erosion of the landscape; and

Describe the effects of human activity (e.g., land development, building of dams, mine development, erosion preventing measures) on physical features of the landscape, and examine the use of rocks and minerals in making consumer products.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 4, students will:

Describe the difference between minerals (composed of the same substance throughout) and rocks (composed of two or more minerals);

Classify rocks and minerals according to chosen criteria, relying on their observations (e.g., colour, texture, shape);

Recognize that there are three classes of rocks: igneous, sedimentary, and metamorphic;

Compare different rocks and minerals from the local environment with rocks and minerals from other places;

Describe the effects of wind, water, and ice on the landscape (e.g., ice breaking rocks into soil), and identify natural phenomena that cause rapid and significant changes in the landscape (e.g., floods, tornadoes, heavy rain storms);

Investigate and describe ways in which soil formed from rocks; and

Identify and describe rocks that contain records of the Earth’s history (e.g., fossils, layer of rock strata), and explain how they were formed.

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 4, students will:

Follow procedures that ensure their safety by covering rock samples with a cloth when chipping and by wearing safety goggles;

Test and compare the physical properties of minerals (e.g., scratch test for hardness, streak test for colour);

Formulate questions about and identify needs and problems related to objects and events in the environment, and explore possible answers and solutions (e.g., design and carry out an investigation using different colour sand layers to show the relationship between volume of water and erosion);

Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing a solution;

Use appropriate vocabulary, including correct science and technology terms, in describing their investigations and observations (e.g., use terms such as hardness, colour, luster, and texture when discussing the physical properties of rocks and minerals);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, and labeled graphs produced by hand or with a computer (e.g., use a chart to record findings obtained through a mineral hardness test); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, oral presentations, written notes and descriptions, drawings, and charts (e.g., put together a labeled exhibit of rocks found in the local environment; create a chart of the physical characteristics of different types of rocks and minerals).

Relating Science and Technology to the World Outside the School

By the end of Grade 4, students will:
Distinguish between natural features of the landscape and those that are the result of human activity (e.g., Virginia Falls, pingos, rapids, farm land, vineyards, mountains, valleys, dames and dykes);

Determine positive and negative effects of human alteration of the landscape (e.g., use of farmland for housing developments; use of wilderness areas for mining, pipeline development; creation of parks);

Identify ways in which soil erosion can be controlled or minimized (e.g., by planting trees, by building retaining walls, water control systems), and create a plan for reducing erosion of soil in the local field or a ditch alongside a road;

Design, build and test a system to control the effects of soil erosion;

Identify the many uses of rocks and minerals in manufacturing, and in arts and crafts (e.g., china, iron fences, soapstone carvings, jewellery, coins); and

Conduct their investigations of the outdoor environment in a responsible way and with respect for the environment (e.g., leave the site of the investigation as they found it, putting back objects examined where they found them and taking away all equipment brought to the site).

EARTH AND SPACE SYSTEMS

Grade 5 - Weather

Overview

The study of weather, which is called meteorology, is an important aspect of daily life. Students will learn that daily weather conditions are not the result of random occurrences, but are rather, part of larger climatic systems and patterns that can be predicted both on a short-term and a seasonal basis. Students will study various aspects of weather (temperature, wind speed, cloud formation, precipitation, atmospheric pressure), and examine the role they play in determining weather conditions.

Big Idea

Weather is affected by climatic factors.

General Learning Outcomes

By the end of Grade 5, students will:
Demonstrate an understanding of the major climatic factors and patterns associated with weather, based on altitude and latitude;
Investigate the major climatic factors associated with weather, and design, construct, and test a variety of instruments for recording various features of the weather; and

Examine how weather forecasts influence decisions concerning human activity and how humans have adapted to a variety of weather conditions.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 5, students will:

Explain the difference between weather and climate and the factors that influence both of these systems (e.g., temperature, relative humidity, wind, air pressure, the sun);

Recognize large-scale and local weather systems (e.g., fronts, air masses, storms);

Predict local weather patterns using data from their own observations of weather and from weather reports;

Explain the formation of clouds and the effects of different cloud formations on weather and climate (e.g., create a model of a cloud in a jar and relate it to the water cycle; describe the relationship between the formation of cumulonimbus clouds and thunderstorms);

Describe the water cycle in terms of evaporation, condensation, and precipitation;

Identify patterns in air movement (e.g., low pressure and high pressure);

Describe the ways in which energy from the sun affects weather conditions (e.g., evaporation of water results in condensation, which in turn results in precipitation);

Identify the effects of air pressure (e.g., low pressure air masses are associated with mild temperature and create conditions that cause thunderstorms or clouds; high pressure air masses are cooler and are often associated with clear weather conditions);

Compare outdoor air movement with indoor air movement (e.g., as hot air rises, cold air takes its place; the warmest rooms in the house are usually the upstairs bedrooms); and

Identify and describe the major could types/formations.

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 5, students will:
Design, construct, and test a variety of weather instruments (e.g., weather vane, anemometer, rain gauge, wind sock, hydrometer);

Formulate questions about and identify needs and problems related to objects and events in the environment, and explore possible answers and solutions (e.g., test a variety of fabrics for their waterproofing or insulating properties);

Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as temperature, precipitation, relative humidity, wind chill factor, barometric pressure, and cloud cover);

Compile data gathered through investigation in order to record and present results, tally charts, tables, and labeled graphs produced by hand or with a computer (e.g., record both qualitative and quantitative data from observations of weather over a period of time; accurately use a thermometer to read and record the results); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, oral presentations, written notes and descriptions, drawings, and charts (e.g., draw a labeled diagram of the water cycle).

Relating Science and Technology to the World Outside the School

By the end of Grade 5, students will:
Describe ways in which weather conditions affect the activities of humans and other animals (e.g., people refrain from strenuous physical activity in extreme heat; animals hibernate in extreme cold; animal fur thickens with cold weather);

Explain how climatic and weather conditions influence the choice of materials used for building shelters (e.g., wood/bricks are often used for building in cold climates, stone, and marble in warmer climates);

Explain how advances in technology and science enable humans to make predictions about weather (e.g., satellite images of the Earth allow us to track weather patterns on a larger scale; computer modeling and automated weather stations);

Understand and explain the importance of weather forecasting for people in certain occupations (e.g., fishers, hunters, farmers, pilots);

Recognize how the movement of large scale air masses affects regional weather in the NWT (e.g., Arctic high pressure systems are associated with clear and cold weather, Atlantic systems are associated with cloudy skies; Pacific systems are associated with a wide variety of weather conditions); and

Explain how weather conditions influence activities and events related to science and technology (e.g., launching the space shuttle, flight testing an aircraft).

EARTH AND SPACE SYSTEMS

Grade 6 - Space

Overview

Space science involves learning about objects in the sky, particularly their form, movements, and interactions. In this strand, students will develop an understanding of Earth and space and of the relationship of Earth to the other bodies in the solar system and beyond. Investigations will involve extensive work with models of the different bodies to allow students to explore their relative size, position, and motion, as well as relationship to one another. In learning about space, students will come to appreciate that our ability to observe and study objects in space has been greatly enhanced by the use of technological devices.

Big Idea

Technology has enhanced our understanding of space and the interactions of heavenly bodies.

General Learning Outcomes

By the end of Grade 6, students will:
Demonstrate an understanding of the patterns of change between heavenly bodies inside and outside the solar system as observed from Earth (e.g., solar and lunar eclipses, tides, phases of the moon, position of the constellations) and of the physical characteristics of the different components of the solar system;
Investigate, using models and simulations, the relationship between the sun, Earth, and moon, the patterns of change observable on Earth that result from the movement of these bodies, and the physical characteristics of the different components of the solar system (e.g., the sun and planets, inner planets and outer planets); and
Describe technological and scientific advances that enable humans to study space, and explain how these advances have affected the quality of life on Earth.

Specific Learning Outcomes

Understanding Basic Concepts

By the end of Grade 6, students will:
Describe the physical characteristics of components of the solar system, the sun, planets, natural satellites, comets, asteroids, and meteoroids (e.g., relative size, surface, colour and temperature);

Identify the bodies in space that emit light (stars) and those that reflect light (e.g., planets, moons, comets);

Describe, using models or simulations, the features of the moon's surface (e.g., craters, Maria, rills);

Identify cycles in nature (e.g., cycles of day and night and seasons) and describe the changes within the cycles (e.g., observe the phases of the moon over several months to determine the pattern of change, and record these observations);

Describe, using models or simulations, how the Earth's rotation causes the cycle of day and night and how the Earth's revolution around the sun causes the cycle of the seasons;

Recognize major constellations visible at night and describe the origins of their names (e.g., such as Orion, Leo, Polaris);

Describe, using models or simulations, the effects of the relative motion and positions of the Earth, moon and sun (e.g., solar and lunar eclipses, tides, phases of the moon); and

Follow safety procedures when observing the sun (e.g., never look at the sun directly

or through a lenses or coloured glass; look only at a projection of the sun's image; do not use lens or magnifiers to focus the sun's rays on a small area; exercise extreme caution when using mirrors so they do not reflect the sun's image directly into someone's eyes).

Developing Skills of Inquiry, Design, and Communication

By the end of Grade 6, students will:
Construct a device that could have been used to tell time before mechanical clocks tools were invented (e.g., sundial);
Formulate questions about and identify needs and problems related to objects and events in the environment, and explore possible answers and solutions (e.g., investigate why craters are of different sizes; print, media, and electronic resources to identify and investigate space technologies, and to investigate images of space and identify what they represent; use a computer simulation program to show the relative size of the planets and their distance from the sun);

Plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions;

Use appropriate vocabulary, including correct science and technology terminology, in describing their investigations and observations (e.g., use terms such as constellations, planets, moons, comets, asteroids, satellites, aurora and meteors to describe objects in space);

Compile data gathered through investigation in order to record and present results, using tally charts, tables, labeled graphs, and scatter plots produced by hand or with a computer (e.g., use print and electronic resources to organize information about the solar system); and

Communicate the procedures and results of investigations for specific purposes and to specific audiences, using electronic media, written notes and descriptions, charts, graphs, drawings, and oral presentations (e.g., prepare a multimedia presentation showing Canada's contribution to space exploration satellites, spacecraft, lunar landers).

Relating Science and Technology to the World Outside the School

By the end of Grade 6, students will:
Describe how humans have improved the tools and techniques used in space exploration (e.g., Canadarm, Hubble and Chandra space telescopes, Lunar rover, Sojourner, Voyager, Mars Rover);

Identify Canadians who have contributed to space science and technology (e.g., Marc Garneau, David Levy, Helen Hogg, Bjarni Tryggvason, Chris Hatfield, Roberta Bondar);

Explain how astronauts meet their basic needs in space (e.g., through the use of dehydrated food, backpacks with an oxygen supply, a hermetically sealed cabin with temperature and air controls);

Identify the technological tools and devices needed for space exploration (e.g., telescopes, spectroscopes, spacecraft, life support systems and sources of energy);

Recognize problems arising from space exploration (e.g., space junk, satellites burning in the atmosphere upon reentry, collisions, micro meteors, radiation);

Identify and describe past and present day contributions to astronomy to the quality of human life (e.g., development of the calendar; prediction of events such as eclipses and seasons; provision of information about space and time,

understanding of the universe); and

Identify the ways in which the development of materials and technology for space exploration has led to the use of new technologies and materials on earth (e.g., micro-electronics, medical imaging, remote sensing, alternate sources of energy).

Science and Technology
NWT Curriculum Framework of Outcomes

NOTES: