Prince Edward Island
CANADA

Department of Education
English Programs

Science
Curriculum

Science

CURRICULUM

Science
431A

Acknowledgments

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I For You, the Teacher

Purpose of this Guide

Transitions is a new concept on Prince Edward Island and as outlined in the 1999 Report of the Senior High School Transitions Advisory Committee, the goal of the Transitions initiative is "to encourage and foster an increase in the education attainment of students and to provide students with the opportunity to obtain academic, personal, social and experiential foundations that will sustain life long learning, the ability to access further training (either on the job or continuing their education), and to equip them in their role as citizens in our society."

- A major commitment has been made by the Department of Education.
- It is recognized that the teacher is a key element to the success of this initiative.
- The information in this guide has been created by teachers for teachers with practical suggestions to support you in the delivery of the curriculum.

People to Know

- Pilot teachers

Charlottetown Rural High School	Patricia Shields
Colonel Gray Senior High School	Rosemary Fleming
Three Oaks Senior High School	Randy Gallant, Stephen Wenn
Westisle Composite High School	Lynn Thomson

- Transitions Department Heads
- your principal
- Director of Curriculum at your school board
- Secondary Coordinator, Department of Education
- Director of English Programs, Department of Education

Contacts for further information and clarification of this guide

- the pilot teachers within your school or at another school
- your principal regarding job shadowing opportunities
- the consultant regarding in-service, resources, and additional support

II Introduction

Background

The Science curriculum has been developed to respond to the continuous and evolving educational needs of students while preparing them for the challenges they will face throughout their lives. Ongoing changes in society such as the expanding use of technology requires a corresponding shift in learning opportunities for students to develop relevant knowledge, skills, strategies, processes, and attitudes that will enable them to function well as individuals, citizens, workers, and learners. To function productively and participate fully in our increasingly sophisticated, technological, information-based society, citizens will be required to be flexible and versatile as they apply their broad literacy abilities with competence.

Program Rationale

The mission of the Prince Edward Island Department of Education is to ensure high quality educational, cultural, and recreational programs and services to all Islanders to promote their social and economic participation to their fullest potential and enhance their well-being and quality of life. A discussion paper on high school transitions was reviewed by members of the Prince Edward Island educational community. The response report that ensued was endorsed by the Minister of Education, the Honourable Chester Gillan, on June 9, 1999. This report identified the need to address the renewal and development of programs.

Course Rationale

The Science 431 course should provide students with an activity-based, meaningful science course. The key is not **what** we teach, but **how** we teach. Content is important, but not as important as having students engaged in relevant learning. It is our belief that a motivated student who is actively learning will be more likely to stay on task, be less disruptive, and attend more regularly. Establishing a classroom climate that is student centred is of utmost importance for the success of this program.

III Program Design and Components

Program Organization

The curriculum is designed to support the foundation documents created and approved in partnership with the other Atlantic Provinces. The Atlantic Provinces Education Foundation (APEF) Essential Graduation Learnings (EGL) statements describe the knowledge, skills, and attitudes expected of all students who graduate from high school. Achievement of the Essential Graduation Learnings will prepare students to continue to learn throughout their lives. These cross-curriculum learnings confirm the need for students to make connections to meet the ever changing workplace in the future. The EGLs serve as a framework for the curriculum developed in this guide.

Essential Graduation Learnings

Aesthetic Expression
Graduates will be able to respond with critical awareness to various forms of arts and be able to express themselves through the arts.

Citizenship
Graduates will be able to assess social, cultural, economic, and environmental interdependence in a local and global context.

Communication
Graduates will be able to use the listening, viewing, speaking, reading and writing modes of language(s), and mathematical and scientific concepts and symbols, to think, learn, and communicate effectively.

Personal Development
Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Problem Solving
Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language, mathematical, and scientific concepts.

Technology Competency
Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

Curriculum Outcomes

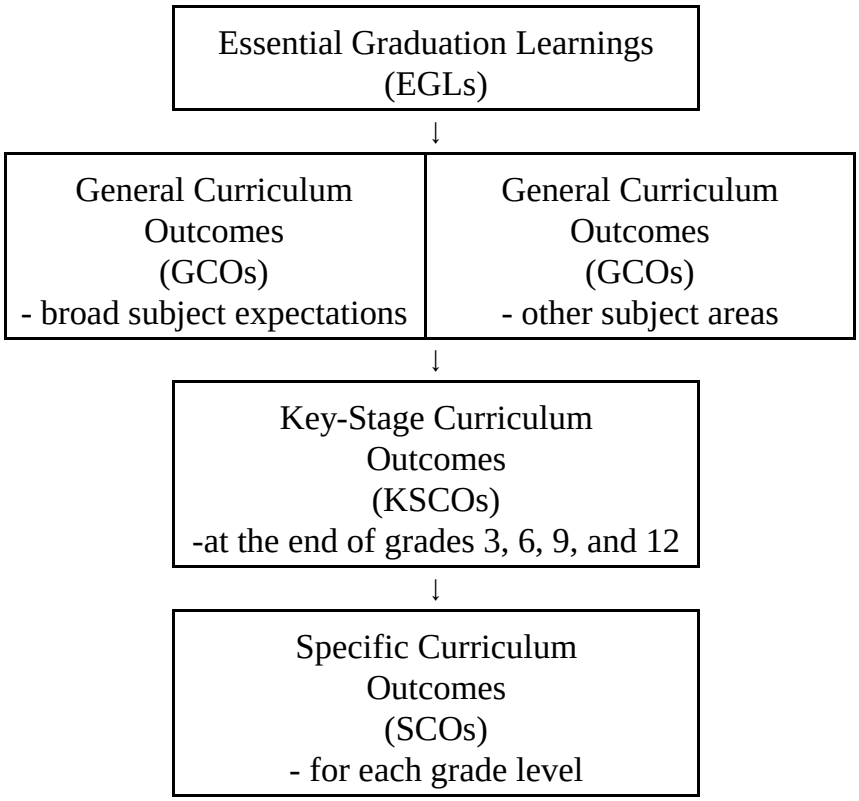
Curriculum outcomes are statements articulating what students are expected to know and be able to do in particular subject areas. These outcome statements also describe the knowledge, skills, and attitudes students are expected to demonstrate at the end of certain key stages in their education. These are based upon their cumulative learning experiences at each grade level in the entry-graduation continuum. Through the achievement of curriculum outcomes, students demonstrate the Essential Graduation Learnings.

General Curriculum Outcomes (GCOs):
are statements that identify what students are expected to know and be able to do upon completion of study in a curriculum area. (See pages 19-22 of this guide.)

Key-Stage Curriculum Outcomes (KSCOs):
are statements that identify what students are expected to know and be able to do by the end of grades 3, 6, 9, and 12, as a result of their cumulative learning experience in a curriculum area. (See pages 19-22 of this guide.)

Specific Curriculum Outcomes (SCOs):
are statements identifying what students are expected to know and be able to do at a particular grade level. These Specific Curriculum Outcomes are found in the first column of the four column spread and are also compiled for your convenience at the beginning of each Unit on pages 27, 51, 67, and 81. They serve as a framework for students to achieve Key Stage and General Curriculum Outcomes.

Organizational Chart



IV Cross-Curriculum Specific Items

Meeting the Needs of all Students

This curriculum is inclusive and is designed to help all learners reach their potential through a wide variety of learning experiences. The curriculum seeks to provide equal entitlements to learning opportunities for all learners. The development of students' literacy is shaped by many factors including gender, social and cultural background, and the extent to which individual needs are met. In designing learning experiences for students, teachers should consider the learning needs, experiences, interests, and values of all students.

In recognizing and valuing the diversity of students, teachers should consider ways to:

- provide a climate and design learning experiences to affirm the dignity and worth of all learners in the classroom community
- redress educational disadvantage - for example, as it relates to students living in poverty
- model the use of inclusive language, attitudes, and actions supportive of all learners
- adapt classroom organization, teaching strategies, assessment strategies, time, and learning resources to address learners' needs and build on their strengths by:
  - providing opportunities for learners to work in a variety of learning contexts, including mixed-ability groupings
  - identifying and responding appropriately to diversity in students' learning styles
  - building upon students' individual levels of knowledge, skills, and attitudes
  - designing learning and assessment tasks that correspond to diverse learning styles
  - using students' strengths and abilities to motivate and support learning
  - offering multiple and varied avenues to learning
- celebrate the accomplishments of learning tasks by students

Gender-Inclusive Curriculum

In a supportive learning environment, male and female students receive equitable access to teachers' assistance, resources, technology, and a range of roles in group activities. It is important that the curriculum, classroom practice, and learning resources reflect the interests, achievements, and perspectives of both males and females.

Teachers promote gender equity in their classrooms when they:

- articulate equally high expectations for male and female students
- provide equal opportunity for input and response from male and female students
- model gender-fair language and respectful listening in all their interactions with students
- promote critical thinking and challenge discrimination

Valuing Social/Cultural Diversity

In order to engage in and maximize learning, all students need to see their social/cultural identities reflected and affirmed in curriculum and classroom practices. It is important to recognize that students in Prince Edward Island come from increasingly diverse ethnic, racial, cultural, and social backgrounds. In addition, they communicate with the wider multicultural world through technology, media, travel, and family and business connections in order to understand their own and others' customs, histories, traditions, values, beliefs, and ways of seeing and making sense of the world. Through experiential learning and through reading, viewing, and discussing authentic texts that reflect diverse social and cultural voices, students from different social and cultural backgrounds can come to understand each other's perspectives, to realize that their own ways of seeing and knowing are not the only ones possible, and to probe the complexities of the ideas and issues they are examining. Curriculum, classroom practices, and learning resources should reflect the diverse and multicultural nature of our society, examine issues of power and privilege, and challenge stereotypes and discrimination.

Engaging All Students

One of the greatest challenges to teachers is engaging students who feel alienated from learning — students who lack confidence in themselves as learners, who have a potential that has not yet been realized. Among them are students who seem unable to concentrate, who lack everyday motivation for academic tasks, who rarely do homework, who fail to pass in assignments, who choose to remain on the periphery of small-group work, who cover up their writing attempts fearing the judgements of peers, who are mortified if asked to read aloud, and who keep their opinions to themselves. These students are significantly delayed when it comes to learning. Some, though not all, exhibit behaviours in classrooms that further distance them from learning. Others are frequently absent from classes. Cumulatively, these are disengaged students.

All students need the experiences that engage them in authentic and worthwhile situations that:

- allow them to construct meaning, connect, collaborate, and communicate with each other
- help them form essential links between the world of science and their own world
- give them a sense of ownership of learning and assessment tasks

They need additional experiences as well - experiences designed to engage them personally and meaningfully, to make their learning pursuits relevant. They need substantial support in reading and writing with positive and motivational feedback. All of these experiences should be within purposeful and interactive learning contexts. Ultimately, the science curriculum for students should help to prepare them for adult life.

Preparing students means engaging them with resources and with people from whom they can learn more about themselves and their world. Many students feel insecure about their own general knowledge and are reluctant to take part in class discussions, deferring to their peers who seem more competent. Through the curriculum, the students must find their own voices. The learning environment must be structured in such a way that all students, alongside their peers, develop confidence and gain access to information and to community.

The greatest challenge in engaging learners is finding an appropriate balance between supporting their needs by structuring opportunities for them to experience learning success and challenging them to grow as learners. Teachers need to have high expectations for all students and to articulate clearly these expectations.

Links to Community

A complete curriculum allows for the flexibility of inclusion of the community through various means. Activities such as guest speakers, field trips, and historical presentations allow the students to become more aware of the influence of the community on their lives. Students gain insight into the current workings of their local society, as well as observe role models and establish contacts with the community.

This curriculum guide provides suggestions, wherever possible, for community involvement to become an integrated part of the course.

Role of Parents and Guardians

Parents and guardians play a crucial role in the educational focus of the students. Although parents and guardians may or may not necessarily feel comfortable to help in specific subject learning with their children, their role is an important link to the development of the students. It is most important that the parents and guardians understand and support the school policies. Parents and guardians are a vital component in the facilitation of the learning of student responsibility in such areas as attendance, safe school policies, goal setting, and career investigations. Schools need parents and guardians to share in their children's successes.

Teachers should invite opportunities for parents and guardians to discuss these matters. Frequent parent-teacher conferences are encouraged via telecommunications and/or school-based meetings.

Involvement in the school councils, home and school associations, and/or other school-based organizations enable parents and guardians to play an active role in the educational development of their children. Parents and guardians may become actively involved as guest speakers in the classroom helping students to understand the community in which they live or as spokespersons on particular careers.

Homework

Homework can extend the opportunity to think and reflect on ideas investigated during class time. Meaningful homework experiences can allow the students to learn self-discipline and team responsibility while acquiring a sense of self-worth.

Homework provides an effective means to model classroom practice. This might involve seeking community input, constructing a model, discussing in groups to prepare a presentation, or answering questions for assessment purposes.

Teachers use their professional judgement to assign homework as a means of reinforcement, assessment and/or further investigation. There should be a limited amount of 'traditional homework" and the home assignments given should relate to the students' interests in real life.

Homework is another channel for parents and guardians to be involved. It is a tool for parents and guardians to understand the focus of their children's education in specific subject areas. In some cases, it opens the opportunity for parents and guardians to become actively involved in the homework process.

The Senior High School Learning Environment

Learning environment for grades 10-12 is:

- participatory, interactive, and collaborative
- inclusive
- caring, safe, challenging
- inquiry based, issues oriented
- resource-based learning which includes and encourages the multiple uses of technology, the media, and other visual texts as pathways to learning and as avenues for representing knowledge

The teacher structures the learning situation and organizes necessary resources. In assessing the nature of the task, the teacher may find that the situation calls for teacher-directed activities with the whole class, small groups of students, or individual students. Such activities include direct instruction in concepts and strategies and brief mini-lessons to create and maintain a focus.

As students develop a focus for their learning, the teacher moves to the perimeter to monitor learning experiences and to encourage flexibility and risk

taking in the ways students approach learning tasks. The teacher intervenes, when appropriate to provide support. In such environments, students will feel central in the learning process.

As the students accept more and more responsibility for learning, the teacher's role changes. The teacher notes what the students are learning and what they need to learn, and helps them to accomplish their tasks. The teacher can be a coach, a facilitator, an editor, a resource person, and a fellow learner. The teacher is a model whom students can emulate, a guide who assists, encourages, and instructs the student as needed during the learning process. Through the whole process, the teacher is also an evaluator, assessing students' growth while helping them to recognize their achievements and their future needs.

Learning environments are places where teachers:

- integrate new ways of teaching and learning with established effective practices
- have an extensive repertoire of strategies from which to select the one most appropriate for the specific learning task
- value the place of dialogue in the learning process
- recognize students as being intelligent in a number of different ways and encourage them to explore other ways of knowing by examining their strengths and working on their weaknesses
- value the inclusive classroom and engage all learners in meaningful activities
- acknowledge the ways in which gender, race, ethnicity, and culture shape particular ways of viewing and knowing the world
- structure repeated opportunities for reflection so that reflection becomes an integral part of the learning process

The physical learning environment should not be restricted to one classroom. There should be ample physical space for students to use cooperative learning techniques as well as other learning styles. There should be access to other learning centres in the school building such as labs and gymnasiums. Learning should be extended to community facilities, allowing field trips and guest speakers to expand the learning environment, while appreciating the focus of the community in their education.

Safety

Students and teachers need to feel safe, both physically and emotionally, in the school setting. In a learning environment where cooperative, active, and collaborative teaching strategies are utilized, students must become knowledgeable of their role in enabling a safe environment to exist.

Empowering students to take ownership for their own safety and that of their peers is an essential component of classroom learning. Teachers can provide students with the knowledge needed to prevent unnecessary risks in their learning environment. By educating students about the risk factors involved in the classroom setting, they can become active participants in the ownership of their own safety. In all learning situations, the teacher needs to encourage a positive, responsible student attitude toward safety.

"To risk is to grow", but to minimize the chance of harm the student must become a conscious participant in ensuring a healthy, safe learning environment. Complacent attitudes regarding safety reflect a behaviour which invites a less protected setting.

While physical safety is of utmost importance in the classroom setting, emotional safety is equally important. Students need to know the unacceptable behaviour and the consequences that ensue. Students should be encouraged to be active learners without being intimidated by others. In every learning environment, teachers foster cooperative, respectful verbal dialogue and physical presence. Student consequences to the contrary are essential components to the learning process.

V Motivation

Motivation plays a very important role in student understanding and successful completion of curriculum. Motivation for the student is heightened when the emphasis within the classroom is placed on the "whole person". This environment provides a focus to recognize achievements accomplished and initiates the growth of a safe place to belong.

Many factors are cited as instruments that foster student motivation. Clear expectations and flexibility of structure enhance the desire to learn. When students have a structure which enables them to accomplish goals, the motivation increases.

Support must exist for both the teacher and the student. A motivational

setting encompasses positive reinforcement as the passionate, energetic teacher promotes curriculum relevant to real life. Daily support for teachers via such modes as "pairing and sharing" techniques, education web sites, and professional development should be available.

Student support should include career awareness. Promoting student goal-setting strategies enables her or him to develop higher self-esteem which is a natural motivator to success.

Varied instructional strategies within the class time also excites motivation. Students need variety, choices, and opportunities to take ownership of their learning.

VI Teaching Strategies

Learning theory research clearly indicates that teachers need to employ a wide variety of instructional strategies to address the learning styles of all learners. Moreover, the nature of certain content or processes can only be taught effectively if specific instructional strategies are employed. In order to achieve this objective, students must have an opportunity to co-operatively brainstorm, discuss, evaluate information and make informed decisions. Students often point to experiential activities as the best part of a program as they have the chance to work cooperatively and be actively involved in the learning process.

Teachers are ultimately responsible for determining the best teaching methods for their student, the best way of grouping them, and the best way to present material to make it relevant and interesting. Exemplary teachers use a variety of instructional strategies and have the flexibility to call upon several different strategies both within one period and during a unit of study. Adolescent learners need a balance between practical work, listening, discussing, and problem-solving.

Direct Instruction is highly teacher-directed consisting of lectures, explicit teaching and demonstrations. It is effective for providing information and developing step-by-step skills.

Indirect Instruction involves inquiry, induction, problem-solving, decision-making and discovery. It is mainly student-centered and is used to generate alternatives and solve problems. The teacher acts as facilitator, supporter and resource person, while the student is highly involved observing, investigating, inferring information from data or forming hypothesis.

Interactive Instruction relies heavily on discussion and sharing among participants. For the teacher it involves management and organizational skills to set up the activities which may involve small groups to class situations. The teacher must observe the students in action and have good record keeping methods. The students will learn from peers and teacher through interactions with both.

INSTRUCTIONAL STRATEGIES

Independent Study includes the range of instructional strategies which are intended to develop individual student initiative, self-reliance, self-improvement, and responsibility for his or her own learning.

Experiential Learning is learner centred, activity oriented, and focussed on the *process* of learning and not on the *product*. Experiential learning can be viewed as a cycle consisting of five phases, all of which are necessary - experiencing, sharing, analyzing, inferring, and applying.

VII Assessment and Evaluation

The terms “assessment” and “evaluation” are often used interchangeably. However, they are not exactly the same. “Assessment” refers to the process of collecting and gathering information about student performance as it relates to the achievement of curriculum outcomes. “Evaluation” refers to the systematic process of analyzing and interpreting information gathered through the process of assessment. Its purpose is to make judgements and decisions about student learning. Assessment provides the data. Evaluation brings meaning to the data. Assessment must reflect the intended outcomes, be ongoing, and take place in authentic contexts.

Meaningful learning involves reflection, construction, and self-regulation. Students are seen as creators of their own unique knowledge structures, not as mere recorders of factual information. Knowing is not just receiving information but interpreting and relating the information to previously acquired knowledge. In addition, students need to recognize the importance of knowing not just how to perform, but when to perform and how to adapt that performance to new situations. Thus, the presence or absence of discrete bits of information - which has been the traditional focus of testing - is no longer the focus of assessment of meaningful learning. Rather, what is important is how and whether students organize, structure, and use that information in context to solve problems.

Evaluation may take different forms depending on its purpose. *Diagnostic* evaluation will identify individual problems and suggest appropriate corrective action. Evaluation may be *formative* in that it is used during the instructional process to monitor progress and to make necessary adjustments in instructional strategies. *Summative* evaluation is intended to report the degree to which the intended curriculum outcomes have been achieved. It is completed at the end of a particular instructional unit.

Since the specific curriculum expectations indicate behaviours involving knowledge, skills, and attitudes, assessment must reflect student performance in each of these areas. The learning outcomes specific to the cognitive domain emphasize the acquisition of cognitive skills at three taxonomic levels: knowledge, understanding, and higher-order thinking. This will help to ensure that the focus on instruction goes beyond the lower levels of learning - recalling facts, memorizing definitions, solving problems, and so on. Likewise, the focus of evaluation should also go beyond testing at the knowledge level.

Assessment/Evaluation Techniques

The evaluation plan should include a wide variety of assessment methods. Any single item of information about a student's learning is only a minuscule sample of that individual's accomplishments. All types of learning outcomes cannot adequately be evaluated with a single type of instrument. Notions about students having different learning styles also apply to their performance on items designed for purposes of evaluation.

Evaluation strategies must closely resemble the nature of the instructional program, curriculum, and modern learning theory. There is significant movement toward authentic assessment or performance assessments. These could include such strategies as open-ended questions, exhibits, demonstrations, hands on execution of experiments, computer simulations, writing, and portfolios of students work over time.

A multifaceted plan is needed to respond to the differences in the intended learning outcomes, the learning styles of students, and to reflect the APEF Essential Graduation Learning.

Individual learning outcomes, the criteria for success and the form that assessment and evaluation will take, should be clearly understood by teachers, students, and parents. This involves clearly describing unit and lesson objectives and how the achievement of these objectives will be assessed. If students are to see themselves as responsible for their own learning, the requirements for attaining success in a unit of work must be clearly understood. The assessment and evaluation of the unit should contain no surprises.

Using Varied Assessment Strategies

Teachers must realize they are preparing students for a world where knowledge is expanding at a rate we can no longer track. This requires that we shift emphasis from content knowledge to information processing skills. Our students need to be able to select, process, and evaluate knowledge.

This knowledge does not always need to be tested directly on evaluations that rely strictly on recall of facts during tests; rather it can be encompassed in higher level objectives such as comprehension, synthesis, or application. These could be better measured through a problem-solving approach.

It is therefore important to emphasize a variety of strategies in evaluation plans. These must reflect the teaching strategies employed in the delivery of the specific topic.

Anecdotal Records are positively written reflections of a student's actions and work while activities are occurring. Each informal assessment entry is typically based on notes or a check list with space for writing comments, used when appropriate.

Testing assesses the student's knowledge and understanding of the subject matter. The most common methods include: essay, column matching, true/false, and multiple choice questions. Also included are problem solving, interpretation and production of graphs, data tables, and illustrations.

Teacher Student Conferences are valuable evaluation techniques to gather information about students not obtained in other ways. Since more information is shared through conversation than through writing, conferencing allows teachers to assess progress more accurately through questioning content and feelings on selected topics. Written records of the conferences are advised.

ASSESSMENT STRATEGIES

Student Work Samples are means for students to communicate what they are learning through a variety of experiences including:

- portfolios - a collection of student's work
- laboratory reports - documentation of experiential activities
- written reports - further research on topics
- homework - opportunity for parent/guardian involvement
- learning journals - individual perceptions of progress
- oral presentations - individual or group form of communicating ideas

Checklists:

Student self-evaluation of:
- interest
- attitudes
- social
- group skills
- understanding

Teacher evaluation of:
- laboratory skills
- groups skills
- interests
- attitudes

VIII Key-Stage Curriculum Outcomes:

General Curriculum Outcomes	**Key-Stage Curriculum Outcomes:** ***By the end of grade 12, students will have achieved the outcomes for entry-grade 9 and will also be expected to*****:**
STSE: Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.	• Describe and explain disciplinary and interdisciplinary processes used to enable us to understand natural phenomena and develop technological solutions • Distinguish between science and technology in terms of their respective goals, products, and values and describe the development of scientific theories and technologies over time • Analyze and explain how science and technology interact with and advance with another • Analyze how individuals, society, and the environment are interdependent with scientific and technological endeavours • Evaluate social issues related to the applications and limitations of science and technology, and explain decisions in terms of advantages and disadvantages for sustainability, considering a variety of perspectives

General Curriculum Outcomes	**Key-Stage Curriculum Outcomes:** ***By the end of grade 12, students will have achieved the outcomes for entry-grade 9 and will also be expected to*****:**
Skills: Students will develop the skills required for scientific and technological inquiry, for solving problems, for communicating scientific ideas and results, for working collaboratively, and for making informed decisions.	• Ask questions about observed relationships and plan investigations of questions, ideas, problems, and issues • Conduct investigations into relationships between and among observable variables, and use a broad range of tools and techniques to gather and record data and information • Analyze data and apply mathematical and conceptual models to develop and assess possible explanations • Work as a member of a team in addressing problems, and apply the skills and conventions of science in communicating information and ideas and in assessing results

General Curriculum Outcomes	**Key-Stage Curriculum Outcomes:** ***By the end of grade 12, students will have achieved the outcomes for entry-grade 9 and will also be expected to*****:**
Knowledge: Students will construct knowledge and understanding of concepts in life science, physical science, and earth and space science, and apply these understandings to interpret, integrate, and extend their knowledge.	**Physics** • Analyze and describe relationships between force and motion • Analyze interactions within systems, using the laws of conservation of energy and momentum • Predict and explain interactions between waves and with matter, using the characteristics of waves • Explain the fundamental forces of nature, using the characteristics of gravitational, electric, and magnetic fields • Analyze and describe different means of energy transmission and transformation **Earth and Space Science** • Demonstrate an understanding of the nature and diversity of energy sources and matter in the universe • Describe and predict the nature and effects of changes to terrestrial systems • Demonstrate an understanding of the relationships among systems responsible for changes to the Earth's surface • Describe the nature of space and its components and the history of the observation of space

General Curriculum Outcomes	**Key-Stage Curriculum Outcomes:** ***By the end of grade 12, students will have achieved the outcomes for entry-grade 9 and will also be expected to*****:**
Attitudes: Students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society, and the environment.	• Value the role and contribution of science and technology in our understanding of phenomena that are directly observable and those that are not • Appreciate that the applications of science and technology can raise ethical dilemmas • Value the contributions to scientific and technological development made by women and men from many societies and cultural backgrounds • Show a continuing and more informed curiosity and interest in science and science-related issues • Acquire, with interest and confidence, additional science knowledge and skills using a variety of resources and methods including formal research • Consider further studies and careers in science and technology-related fields • Confidently evaluate evidence and consider alternative perspectives, ideas, and explanations • Use factual information and rational explanations when analyzing and evaluating • Value the processes for drawing conclusions • Work collaboratively in planning and carrying out investigations, as well as generating and evaluating ideas • Have a sense of personal and shared responsibility for maintaining a sustainable environment • Project the personal, social, and environmental consequences of a proposed action • Want to take action for maintaining a sustainable environment • Show concern for safety and accept the need for rules and regulations • Be aware of the direct and indirect consequences of their actions

IX Support Resources

Curriculum Guide

* **Nelson, *Science 10-Concepts and Connections* - Student Text**
Nelson, *Science 10 - Concepts and Connections*, Teacher's Resource

* These resources are in bold print under the Suggested Resources column in the Curriculum Guide. They are the only **authorized resources** for this curriculum.

Copies of the following support resources may be found in your school:
Nelson, *Science 10 - Concepts and Connections*, Student Record of Learning
Nelson Applied 10 - Teacher resource
Investigating Terrestrial Ecosystems - Teacher resource
Ecosystems
Nelson, *Science 10*, Teacher's Resource, Applied Supplement
Nelson, *Science 10*, Teacher's Resource, Chemical Processes
McGraw-Hill Ryerson, *Sciencepower 10*
McGraw-Hill Ryerson, *Sciencepower 10*, Blackline Masters
McGraw-Hill Ryerson, *Science Power 10*, Teacher Resource Binder

Science 431A

Unit 1

Ecosystems

Ecosystems: Unit Overview

Introduction

This unit emphasizes the need for students to understand how ecosystems change and how they are sustained. They will investigate factors and analyze issues that effect the sustainability of ecosystems.

Human activities can create imbalances in ecosystems, leading to environmental problems. A sustainable system exists when the effects of human activity do not exceed the ability of the environment to become stable again.

Teachers may choose to teach this unit when the weather is appropriate for field trips. If this is a first semester course, teachers may teach Unit 1 first. If it is a second semester course, teaching this Unit late in the semester may be more appropriate.

Curriculum Links:

The study of ecosystems in Grade 10 connects readily with topics covered as early as Grade 1 where students are taught to recognize that humans and other living things depend on their environment, as well as in Grade 2 where students observe and explore materials and events in their immediate environment and record the results. These early considerations of ecosystems are given more attention and detail by the end of Grade 6 as causes, effects, and patterns related to change in living and non-living things are studied. By the end of Grade 9, students explain processes responsible for the continuity and diversity of life.

Sustainability of Ecosystems: Specific Curriculum Outcomes for this Unit

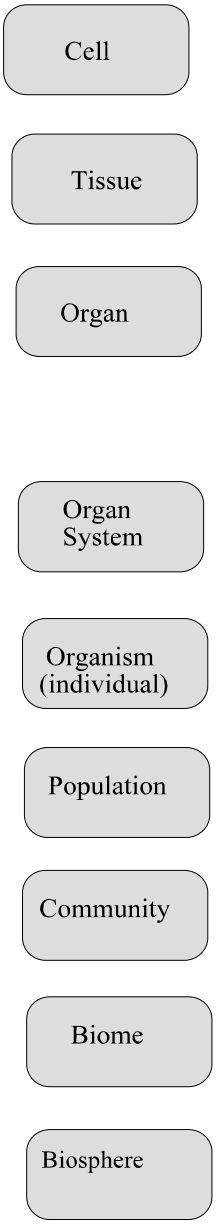
STSE	SKILLS	KNOWLEDGE
Nature of Science and Technology 114-1 Explain how a paradigm shift can change scientific world views in understanding sustainability. Explore and develop a concept of sustainability. 114-5 Describe the role peer review has in the development of scientific knowledge. **Relationships between Science and Technology** 116-1 Identify scientific examples where scientific understanding about an ecosystem was enhanced or revised as a result of human invention or related technologies. **Social and Environmental Contexts of Science and Technology** 118-1 Compare the risks and benefits to the biosphere of applying new scientific knowledge and technology to industrial processes. 117-3 Describe how Canadian research projects in environmental science and technology are funded.	**Initiating and Planning** 212-4 Plan changes to, predict the effects of, and analyze the impact of external factors on an ecosystem. **Performing and Recording** 213-7 Select, compile, and display evidence and information from various sources, in different formats, to support a given view in a presentation about ecosystem change. 213-8 Plan changes to, predict the effects of, and analyze the impact of external factors on an ecosystem. **Analyzing and Interpreting** 214-1 Describe and apply classification systems and nomenclature with respect to trophic levels in ecosystems. Classify organisms as producer, consumer, autotroph, heterotroph, decomposer, herbivore, carnivore, omnivore, or saprobe. 214-3 Select, compile, and display evidence and information from various sources, in different formats, to support a given view in a presentation about ecosystem change. **Communication and Teamwork** 215-1 Communicate questions, ideas, and intentions and receive, interpret, understand, support, and respond to the ideas of others with respect to environmental attitudes.	318-2 Describe the mechanisms of bioaccumulation, and explain its potential impact on the viability and diversity of consumers at all trophic levels. 331-6 Plan changes to, predict the effects of, and analyze the impact of external factors on an ecosystem. 318-5 Explain biotic and abiotic factors which keep natural populations in equilibrium and relate this equilibrium to the resource limits of an ecosystem. 318-1 Illustrate the cycling of matter through biotic and abiotic components of an ecosystem by tracking carbon, nitrogen, and oxygen. 318-6 Explain how biodiversity of an ecosystem contributes to its sustainability. 331-6 Analyze the impact of external factors on the ecosystem. 331-7 Describe how soil composition and fertility can be altered and how these changes could affect an ecosystem. 318-4 Explain why the ecosystem may respond differently to short-term stress and long-term change. 318-3 Explain why ecosystems with similar characteristics can exist in different geographical locations.

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
212-4 State a prediction and a hypothesis based on available evidence and background information. 118-9 Propose a course of action on social issues related to science and technology taking into account human and environmental needs. 331-6 Analyze the impact of external factors on the ecosystem.	Students will need the following introduction to be able to successfully complete the unit. The various concepts of environment (living, non-living, total), open and closed systems, and ecology will be the focus through this introduction. As an opportunity to invite a class/group discussion, have students read/listen to the following short article on "Space Ship". Follow up the reading by asking them to identify factors that contribute to life on a space ship. Decompose this environment into living versus non-living components. Space Ship Article Imagine yourself on a spaceship about to blast off for a distant planet. The spaceship would be carrying all the food you were going to use on the journey. It would carry all the water you need, all the air you need to breath and would have to be heated so you could survive the sub-zero temperatures of outer space. It would have to contain means for storing all the wastes that were produced en route, and if the trip was to be a long one, the wastes would have to be re-cycled, or used again, to help grow additional food. The spaceship, in short, would have to contain a complete system for supporting life. Needless to say, if anything went wrong, the lives of all the people on the spaceship would be in danger. Specific circumstances where technology has had a detrimental affect on a population should be examined.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Discussion Does this seem far fetched? Does it seem unlikely that you will ever take a space voyage? If at first thought your answer is "yes", it would be wise to think about it again. For you are on a spaceship, and we call it the planet Earth. It contains all the air we need to breathe, all the water we will use for drinking and for many other purposes, and it is a complete life support system. Furthermore, if anything goes wrong with this system, the lives of all passengers on Spaceship Earth will be in danger. Some scientists say we already are. Further promote this concept by comparing the living environment at a school on a Friday versus the non-living environment on a Saturday. Students may make connections to such things as populations, migrations, air quality, etc.	**Nelson, *Science 10-Concepts and Connections***, pages 6-7 **Nelson, *Science 10-Concepts and Connections*, Student Record of Learning (workbook)**, pages 2-6
Discussion • Examine the decline of the frog population in North America and discuss the contributing factors, such as: loss of habitat, air and water quality, UV radiation, and climate change.	**Nelson**, ***Science 10-Concepts and Connections***, pages 8-13 **Nelson**, ***Science 10-Concepts and Connections***, **Student Record of Learning (workbook)**, pages 7-15

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
214-3 Compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots. 318-5 Explain biotic and abiotic factors which keep natural populations in equilibrium and relate this equilibrium to the resource limits of an ecosystem. 213-7 Select and integrate information from various print and electronic sources or from several parts of the same source. 114-5 Describe the importance of peer review in the development of scientific knowledge.	Suggested pair activity: Other options to discuss this idea might include giving school maps to the students. These maps would be pre-marked with a black marker to indicate a certain area of the school. Each map would be different. Have the pair of students identify the biotic and abiotic environment in the area assigned. What do living things do to a non-living space? A discussion would follow inviting answers to such questions as: • Why do people put fish tanks in hallways at work? • Why are living things put in non-living environment? Optional location to explore the biotic and abiotic: If the school location is advantageous to exploring living and non-living parts of an ecosystem, the teacher may wish to have students investigate these concepts outside the school building. For example: an open soccer field, a pond, a marsh, a ditch, a stream, or a forest. From these explorations within and/or outside the school, students will suggest improvements and enhancements to include the need for the living component in our environment. An appropriate closure to this introduction should include the evolution of the definition of ecology as it compares to biology. Explore the meaning of "eco" as it pertains to ecology, ecosystem, ecotourism, and other "ecos" on Prince Edward Island.

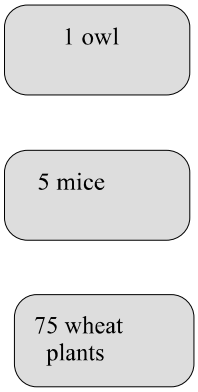
Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Pencil/Paper List and define key words associated with ecology, such as: biotic, abiotic, population, community, and biogeography.	**Nelson, *Science 10-Concepts and Connections***, pages 14-15 **Nelson, *Science 10-Concepts and Connections*, Student Record of Learning (workbook)**, pages 16-17 **Nelson, *Science 10-Concepts and Connections*, Investigation** pages 18-19 **Nelson, *Science 10-Concepts and Connections*, Student Record of Learning (workbook**), pages 21-23

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
214-1 Describe and apply classification systems and nomenclature used in the sciences. 214-3 Compile and display evidence and information, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.	Introduce the ecological organization on the earth from simplest to most complex. 

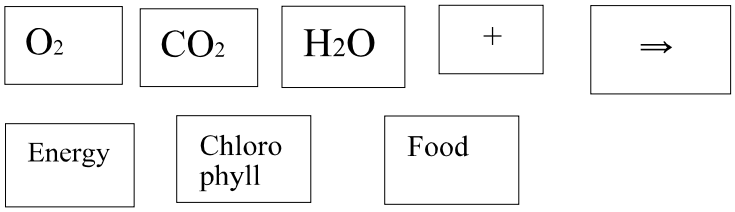
Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Use the preceding ecological chart to do a mailing analogy of the universe. Example: room, house, street, town, county, province, region, country, continent, planet (Earth), solar system, galaxy, universe.	*Investigating Terrestrial Ecosystems* *General Science* See page 108 in Appendix for list of videos available from the Confederation Centre Public Library Telephone: 368-4642 or 368-4562 Fax: 368-4621 E-mail: video_library@edu.pe.ca Opportunity for video on: *Photosynthesis* or Earth at Risk The Confederation Centre Public Library has duplication rights for *Photosynthesis* so any school that would like a copy can have it. Teachers can arrange to have copies made by sending in a high quality tape to the Confederation Centre Public Library (Dorothy's attention) and a copy will be made.

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
214-1 Describe and apply classification systems and nomenclature used in the sciences. 318-2 Describe the mechanisms of bioaccumulation, and explain its potential impact on the viability and diversity of consumers at all trophic levels. 215-1 Communicate questions, ideas, and intentions and receive, interpret, understand, support, and respond to the ideas of others. 118-5 Defend a decision or judgement and demonstrate that relevant arguments can arise from different perspectives.	Students will be expected to recognize the order of the ecological organization as well as to have an understanding of the components of the flow chart. This includes: Biological: (cell - organism) Ecological: (organism - biosphere) Introduce the concepts of producers, consumers, and decomposers. Further to this breakdown, teachers should delineate consumers into carnivore, herbivore, and omnivore. Students should understand habitat, niches, and competition in relationship to their occupation and their home. Investigation: Take a product from the grocery store and trace its origin and composition. Trace the ecosystem as far as understanding covered to date in this unit. Examples could include cereal, fish and/or beef. Discuss: “Think globally, act locally”. Field trip opportunity: Visit the Money Mushroom Plant in Freetown. Group Activity: Examine the components of an ecosystem specific to Prince Edward Island. Groups will present their findings to the entire class. Choose a current ecology concern such as pesticide use, DDT, Blue Fin Tuna Regulations, or a fish kill. Debate, discuss by panel and/or invite a guest speaker are among some of the teaching strategies that could be utilized here. This should lead into an understanding of energy flow through an ecosystem.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
	Nelson, *Science 10-Concepts and Connections*, pages 22-25 **Nelson, *Science 10-Concepts and Connections*, Student Record of Learning (workbook)**, pages 28-32 **Nelson, *Science 10-Concepts and Connections*, Case Study**, pages 34-37 *Ecosystems*, page 13 *Investigating Terrestrial Ecosystems*, pages 18-19

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
318-2 Describe the mechanisms of bioaccumulation, and explain its potential impact on the viability and diversity of consumers at all trophic levels. 214-3, 213-7 Select, compile, and display evidence and information from various sources, in different formats, to support a given view in a presentation about ecosystem change.	A review of the components of the food chain will enable the students to link trophic levels in an ecosystem. An understanding of a food web as a suggested multiple food chain is essential to move into the following activity: Activity: Create a food web from 30 species of plants and animals found on Prince Edward Island. To understand food pyramids, the following visual will initiate an introduction to bioaccumulation and energy flow. The pyramid could be the number of animals and/or energy. Example: 

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Invite a Conservation Officer as a guest speaker. *Debate* Have students take a stand on the perception of the value of wolves and their impact on the energy of an ecosystem.	**Nelson, *Science 10-Concepts and Connections***, pages 16-17 **Nelson, *Science 10-Concepts and Connections***, pages 22-25 **Nelson, *Science 10-Concepts and Connections*, Student Record of Learning (workbook)**, pages 18-20 *Ecosystems*, pages 10 and 13 *Investigating Terrestrial Ecosystems*, pages 28-29

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
318-1 Illustrate the cycling of matter through biotic and abiotic components of an ecosystem by tracking carbon, nitrogen, and oxygen.	Students will explore nutrient cycles, specifically carbon, water, nitrogen, and oxygen. The carbon and oxygen components of these cycles are a natural follow up to the connection previously made with photosynthesis and respiration. Activity: Use the coloured rectangular overheads of the following rectangles:  Paired Activity: Teachers will write the above rectangles on the chalkboard. Have the students create the proper equations for photosynthesis and respirations at their paired seats. Choose one pair to arrange the coloured overheads for the class. This activity could be used to demonstrate other nutrient cycles specifically: water, carbon, and nitrogen. Teachers may choose to make more of these rectangles and to give them to students to arrange according to the cycle. Alternate Activity: Ask students to complete the cycle found on page 127 in the appendix in this guide or one similar to it.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Connect photosynthesis and respiration noting that products of one are reactants to the other. This may require a brief review of the photosynthesis and respiration concepts from the in-depth study at the Intermediate level. The main idea is to connect these concepts. *Activity* Students design a poster board depicting the carbon, nitrogen, or oxygen cycle.	**Nelson, *Science 10-Concepts and Connections***, pages 26-30 *Using Your Knowledge Investigating Terrestrial Ecosystems* Prentice-Hall Canada Inc. (1986), page 15 *Ecosystems*, page 8 and 38 *Investigating Terrestrial Ecosystems*, pages 40-46

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
318-5 Explain various ways in which natural populations are kept in equilibrium and relate this equilibrium to the resource limits of an ecosystem. 331-6 Analyze the impact of external factors on an ecosystem. 318-6 Explain how the biodiversity of an ecosystem contributes to its sustainability. 318-5 Explain various ways in which natural populations are kept in equilibrium and relate this equilibrium to the resource limits of an ecosystem.	**Introduction to Carrying Capacity and Territory:** The concept of carrying capacity is a result of too many organisms in a home range. The following activities will lead the students to an understanding of this concept. Ask students to put their desks together without spaces between them and be seated. Describe the concept of capacity while focusing on the space in their room. Discuss these controls and population needs. Utilizing an atlas, examine a map of Prince Edward Island comparing other countries to its population per square metre. Discuss why the Japanese culture evolved with fish as their primary source of protein. Discuss the over-harvesting of the rice paddies in Asia leading to the depletion of the soil content as compared to the Prince Edward Island potato industry. Students will be asked to describe what is required to survive: food, shelter, water, air... Evolving from this should be a discussion of human staking his or her own territory or home range. A comparison of a mouse to a fox's home range or territory can also be determined. This can be tied into the pyramid effect.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Discuss why wardens are hired, hunting licences are sold, and poachers apprehended.	Activities in Project Wild **Nelson, *Science 10-Concepts and Connections***, pages 38-41 Video to be used as an introduction/review: • *Ecosystems and the Biosphere* Cycles of Life: exploring Biology Series 432-31-913 30 minutes • *Population and Communities* 432-31-912 Magic Lantern Communications Ltd.

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
318-4 Explain why different ecosystems respond differently to short-term stresses and long-term changes. 215-4 Identify multiple perspectives that influence a science-related decision or issue. 331-6 Analyze the impact of external factors on an ecosystem. 318-3 Explain why ecosystems with similar characteristics can exist in different geographical locations. 214-1 Describe and apply classification systems and nomenclature used in the sciences. 213-7 Select and integrate information from various print and electronic sources or from several parts of the same source.	**Succession:** Opportunity for discussion/workstation. Have students explore various changes in Prince Edward Island Ecosystems. Examples: sand dunes forests Teachers should seize the opportunity to discuss succession through current articles on Prince Edward Island Ecosystems such as Greenwich. Students should come to an understanding of the impact of humans on the ecosystem. An examination on the Island Forest Industry could be utilized here. Now that students have investigated ecosystems in Prince Edward Island, they should be exposed to the types of biomes that exist globally. Students should discover the concept of biomes and various climates of the world in relation to ecosystems. Activity: (Time Allotment 50 minutes) Rainforest Debate See page 114 of the Appendix. Draw a parallel between Canadian Forestry practices and South American Forestry practices. Further discussions should occur on Prince Edward Island Forestry. Guest Speaker Opportunity: A Department of Forestry spokesperson could be contacted.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Project/Resource Centre Workstations Students should investigate some natural or human changes to ecosystems. One such investigation could include changes to the National Parks to enhance Tourism	**Nelson, *Science 10-Concepts and Connections***, pages 42-44 and 50-51 *Ecosystems*, page 27 *Biomes* - a video available at the Media Center - see page 108 of the appendix *Investigating Terrestrial Ecosystems*, pages 53 and 63 The old STS booklet has a good section titled “Acadian Forest”

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
215-4 Identify multiply perspectives that influence a science-related decision or issue.	Students will be exposed to the topic of sustainability through the activity on population growth rate found on pages 122 and 123 in the Appendix of this guide. From the activity, a formal definition of sustainability should evolve. This should be applied to Prince Edward Island wildlife, soils, forestry, and fisheries to the extent that the student becomes aware that the resource is preserved for future use and that it does not negatively impact on other ecosystems.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Examples include: • aboriginal claims of natural resources • closing of the cod fishery • Waste Watch • lobster catches • tuna fishery	Population Growth Rates Appendix pages 122 and 123 **Nelson, *Science 10-Concepts and Connections***, pages 45 and 50-51

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
114-1 Explain how a paradigm shift can change scientific world views. 116-1 Identify examples where scientific understanding was enhanced or revised as a result of the human invention of a technology 118-1 Compare the risks and benefits to society and the environment of applying scientific knowledge or introducing a new technology. 117-3 Describe how Canadian research projects in science and technology are funded.	Students will examine soil composition from the following experiment: Experiment Soil composition and erosion 2 Samples: Sample 1: - full of humus Sample 2: - clay based • salt shakers full of water • tilt containers of soil (shallow tray) • sprinkle "rain" over samples • run off from sample 1 should be minimal and filtered clean • run off from sample 2 was full of silt and abundant From this experiment, discussion should follow about sustainable practices and risks. For example, aquaculture, soil erosion techniques, composting, waste management, the bypass of Ellen's Creek in Charlottetown. Students should investigate how research projects in science and technology are funded to aid in Canada's Sustainability practices. Teachers should cite future courses in Grade 11 and 12 that further develop this unit.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
	Nelson, ***Science 10-Concepts and Connections,*** pages 46-49 Excellent labs on pages 12, 13, and 33 in *Investigating Terrestrial Ecosystems*

Science 431A

Unit 2

Chemical Reactions

Chemical Reactions: Unit Overview

Introduction:

This unit emphasizes the social and environmental contexts of science and technology associated with air and water pollution and should have a principal focus of **observation** and **inquiry**. However, there are opportunities for **decision making** as well as design technology in the laboratory research components of this unit. Atlantic Canada offers a possible context for this unit because it is particularly affected by acid precipitation and other forms of air pollution due to prevailing winds in North America. These winds carry large amounts of air pollutants from the more populated and industrialized regions of the United States and Canada. The problem is further complicated by our own industrial plants and power generation plants. In addition, much of our region has thin soil and granite bedrock, which makes the region highly sensitive to acid damage. In this context students will consider how chemical reactions are associated with technologically produced problems such as acid rain and look at some steps that can be taken to counter the effects of acid rain.

Curriculum Links:

The study of chemical reactions in Grade 10 connects readily with topics covered as early as Grade 1 where students are introduced to materials and their senses, as well as in Grade 2 where students are introduced to the idea of liquids and solids. These early considerations of states of matter are given more attention and detail in Grade 5 as properties and changes in materials are studied. By Grade 7 students cover in some detail the concept of mixtures and solutions.

Chemical Reactions: Specific Curriculum Outcomes for this Unit

STSE	SKILLS	KNOWLEDGE
Nature of Science and Tech. 114-8 Describe the usefulness of scientific nomenclature systems. **Relationships between Science and Technology** 116-3 Identify examples where technologies were developed based on scientific understanding. 116-5 Describe the functioning of domestic and industrial technologies using scientific principles. **Social and Environmental Contexts of Science and Technology** 117-1 Compare examples of how society influences science and technology. 117-5 Provide examples of how science and technology are an integral part of their lives and community. 117-7 Identify and describe science and technology-based careers related to the science they study. 118-5 Defend a decision or judgement and demonstrate that relevant arguments can arise from different perspectives.	**Initiating and Planning** 212-3 Design an experiment identifying and controlling major variables. 212-8 Evaluate and select appropriate instruments for collecting evidence and appropriate processes for problem solving, inquiring, and decision-making. **Performing and Recording** 213-2 Carry out procedures controlling the major variables and adapting or extending procedures where required. 213-5 Compile and organize data, using appropriate formats and data treatments to facilitate interpretation of the data. 213-9 Demonstrate a knowledge of WHMIS standards by selecting and applying proper techniques for handling and disposing of lab materials. **Analyzing and Interpreting** 214-5 Interpret patterns and trends in data, and infer or calculate linear and nonlinear relationships among variables. 214-15 Propose alternative solutions to a given practical problem, identify the potential strengths and weaknesses of each, and select one as the basis for a plan. **Communication and Teamwork** 215-6 Work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise.	319-2 (I) Classify substances as acids, bases, or salts, based on their characteristics. 321-2 Describe how neutralization involves tempering the effects of an acid with a base or vice versa. 319-1 (II) Name and write formulas for some common ionic compounds (both binary and complex) using the periodic table, a list of ions, and appropriate nomenclature for metal and non-metal ions. 319-2 (II) Classify substances as acids, bases, or salts, based on their name and formula. 319-3 Illustrate, using chemical formulas, a wide variety of natural and synthetic compounds that contain carbon. 321-1 Represent chemical reactions and the conservation of mass using molecular models, and balanced symbolic equations. 321-3 Illustrate how factors such as heat, concentration, light, and surface area can affect chemical reactions.

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
319-2 (I) Classify substances as acids, bases, or salts, based on their characteristic properties.	A detailed study of acids, bases, pH, etc. is not expected at this point. Sections 2.13-2.16 offer a more detailed study. However, students should have a basic understanding of simple diagnostic tests associated with acids, bases, and salts. This should include points such as acids have a sour taste, *(if edible),* turn blue litmus red, react with active metals, conduct electricity, and neutralize bases. By contrast, bases are bitter, feel slippery, turn red litmus blue, and neutralize acids. Salts conduct electricity but do not change the color of litmus paper.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Performance Investigate household products recognizing acids and bases. *Presentation and Performance* Work in groups to design a game for naming common acids and bases. Each group in turn will test their game on other groups in the class.	**Nelson, *Science 10-Concepts and Connections***, pages 70-71 **Nelson, *Science 10-Concepts and Connections*, Student Record of Learning**, pages 102-107

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
117-5 Provide examples of how science and technology are an integral part of their lives and their community by investigating common examples. 114-8 Describe the usefulness of IUPAC scientific nomenclature systems to convey chemical information. 319-1 (II) Name and write formulas for some common ionic compounds (both binary and complex) using the periodic table, a list of ions, and appropriate nomenclature for metal and non-metal ions.	To introduce the process of students becoming chemically literate, students must investigate chemical changes encountered in their daily lives. To ensure that students are aware of what constitutes a chemical change, present several contrasting examples of how chemical change is different from physical change. Inform the students of the existence of the International Union of Pure and Applied Chemistry (IUPAC) as a global organization of scientists that is responsible for setting standards in chemistry. The IUPAC has developed a system of naming compounds that anyone studying or working in chemistry can understand. Students must be made aware that the unique naming system of IUPAC absolutely distinguishes a compound from any other compound that exists. Emphasize the link established in writing a chemical formula from a compound's name and needing the chemical formula(s) to write chemical equations. It is suggested that an overview of the fundamental use of the Periodic Table would be valuable in predicting and writing formulas in terms of equation writing for single replacement reactions and double replacement reactions. Formula writing skills are essential. Focus on teaching students how to write the correct chemical formula for an ionic compound using the periodic table, a list of common polyatomic ions, and the cross-over rule of subscripting.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Selection(s) from the following tasks will enable students to demonstrate their understanding of the role of science and technology in society. *Pencil/Paper* Have students produce a one-to-two page, word-processed report on this topic. Labelled diagrams can be included. This report can be photocopied and handed out to classmates. *Performance* Produce a colourful poster that will be displayed in your classroom. *Presentation* Do a five-to-ten minute presentation to the class. Originality, video cameras, and computer graphics are encouraged. Other suggested topics for this assignment include: air bags, detergents, cooking, acid rain, catalytic converters, swimming pools, and food preservation. *Observation* • the Russian Periodic Table • compare generic and name brand products with identical chemical content • discuss the 10 year patent law *Pencil/ Paper* Worksheets found on pages 147 and 148 of the Appendix on naming compounds of increasing difficulty. *Assessment* • student handout • poster • presentation • group work with self evaluation	**Nelson, *Science 10-Concepts and Connections***, pages 72-75 *Sciencepower* 10, pages 210-227 *Science 10*, pages (168-169) plus sections 5-1, 5-2, 5-13, 7-4, 7-10 *Science Power 10*, Teacher Resource Binder, page 77 *Nelson*, Blackline Master 7.8 *Science Power 10*, Blackline Master 6.5, 6.6, and 7.5, pages 107, 112, and 122 overhead provided *Sciencepower 10*, page 155 Addison Wesely, Chapter 25 *Sciencepower 10*, Blackline Master, page 102-103 **Nelson, *Science 10-Concepts and Connections***, pages 76-81 **Nelson, *Science 10-Concepts and Connections*, Student Record of Learning**, pages 108-112 Nelson, Blackline Master 5.8, *Easy Chemistry Demonstrations*, pages 65-69 *Sciencepower 10*, Blackline Masters 5.2, 5.4, and 6.7, pages 97, 99, and 113

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
319-1 (I) Name and write formulas for common molecular compounds, including the use of prefixes. 319-3 Distinguish between organic and inorganic compounds on the basis of their formulas. 319-3 Illustrate, using chemical formulas, a variety of natural and synthetic compounds that contain carbon. 213-9 Demonstrate a knowledge of WHMIS standards by selecting and applying proper techniques for handling and disposing of lab materials.	Use molecular models to demonstrate correct naming and writing of molecular formulas for a variety of molecular compounds such as methane, water, hydrogen peroxide, ozone, sucrose, ethanol, and methanol. Be sure to cover not only common names such as methane, CH_4, but also the systematic approach of using prefixes mono, di, tri, etc. for binary compounds such as sulphur dioxide and sulphur trioxide. Through using IUPAC nomenclature, students should start to appreciate the usefulness of a common naming system. Point out to the students that molecular compounds consist of non-metals while ionic compounds consist of metals and non-metals. Also note that acids usually start with hydrogen. Students should be made aware that all organic compounds contain carbon and hydrogen along with other possible elements such as oxygen, but some compounds containing carbon (e.g. $CaCO_3$, CO_2) are classed inorganic. Emphasize the point that organic (carbon) compounds are far more numerous in our world than inorganic compounds. No systematic naming of organic chemicals is required at this point. Illustrations, by drawing and building models, should be limited to common organic compounds such as: methane [CH_4], propane [C_3H_8], butane [C_4H_{10}], octane [C_8H_{18}], ethanol [C_2H_5OH]. For complex organic compounds such as CFCs and polyethylene, use common names only. Examine the role and use of the MSDS (Material Safety Data Sheet) in the workplace and in the handling of WHMIS controlled products in a safe manner. Safe practices and proper use of equipment are very important in the laboratory. For all laboratory activities in this unit be sure students recognize WHMIS standards.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Pencil/Paper Worksheet on naming molecular compounds. *Performance* Construct various organic compounds, using molecular model kits. *Research* Students should be assigned a specific chemical and asked to research: handling precautions, harmful effects, treatment, and proper disposal. Chemicals should include both lab and household products. Discuss the dangers of chemical cocktails (eg: bleach and ammonia). *Technology* Students can be asked to locate an internet site on MSDS (Material Safety Data Sheet) for a specific chemical from a chemical supplier.	**Nelson, *Science 10-Concepts and Connections***, pages 78-81 **Nelson, *Science 10-Concepts and Connections, Student Record of Learning***, pages 113-115 *Sciencepower 10*, pages 162-163 *Science 10*, pages 201-204 Nelson, Blackline Master 5.11 *Sciencepower 10*, Blackline Masters 5.5 and 5.6, pages 100-103 Science 10, Applied Supplement, Blackline Master 5.11 *Sciencepower 10*, pages 203 *Science 10*, pages 205-212 Molecular model kits *Practical Chemistry Labs*, # 39, page 166 *Sciencepower 10*, Blackline Masters 6.2, 6.3, and 6.4, pages 108-110 *Science 10, Applied Supplement*, Blackline Master 8.2 See Appendix WHMIS items on pages 141-143 *Sciencepower 10*, pages 608 *Science 10*, pages 658 and pages 174-179 Internet and Library Resources *Science Safety Guidelines*, (APEF DRAFT)

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
321-1 Represent chemical reactions and the conservation of mass using molecular models and balanced symbolic equations. 321-3, 212-3, 213-2 Design, carry out, and control variables to illustrate how factors such as heat, concentration, and surface area can affect chemical reactions.	Present word equations as an introduction to chemical shorthand which allows chemists to describe as concisely as possible a chemical reaction. Choose examples to illustrate the format of word equations. Where possible, demonstrate the reaction so students are able to see the distinction between reactants and products. Types of Chemical Reactions Explain to students that similar chemical reactions often involve the same kinds of reactants and the same kinds of products. For example, in the complete combustion reaction: Fuel + oxygen $\rightarrow$carbon dioxide + water In a synthesis reaction, both reactants, no matter how simple or how complex, combine to form a single product. Decomposition Reactions, on the other hand, are the reverse; a complex reactant breaks down into simple products. Demonstrate each of a synthesis and a decomposition reaction. Have students write the word equation and balanced chemical equation for each reaction.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Demonstration Mix equal concentration and amounts of acid and base. $HCl + NaOH \rightarrow NaCl + H_2O$ Evaporate the water to produce salt. Other demonstrations of replacement reactions may be used. *Manipulatives* Encourage students to use molecular models to visualize balanced chemical reactions. *Pencil/Paper* Worksheets on types of reactions *Demonstration* To demonstrate the affects of a catalyst, mix 25 mL of 30% H_2O_2 (Hydrogen Peroxide) with 10 mL of soap (liquid white) with 5 mL of saturated KI (Potassium Iodide). Have students write and balance reactions that illustrate a variety of reaction types, including combustion, formation, decomposition, single replacement, and double replacement	**Nelson, *Science 10-Concepts and Connections***, pages 86-87 **Nelson, *Science 10-Connections and Concepts,* Student Record of Learning**, pages 124-125 *Sciencepower 10*, pages 170-195 and 240-241 *Science 10*, pages 218-219, 226-229 and 233-235 Nelson, Blackline Master 6.5C *40 Low Waste, Low Risk Chemistry Labs*, page 10 *40 Low Waste, Low-Risk Chemistry Labs*, Experiment 15, page 97 Nelson, Blackline Masters 6.8 C synthesis 6.9 decomposition 6.11 single displacement 6.12 double displacement 6.13 general overview Nelson, Blackline Masters 7.3 B catalyst 7.5 surface/area *75 Easy Chemistry Demonstrations*, lab #37, Demonstrates Effects of Surface Area and Heat Application Appendix item “King Kong’s Hand”, page 144

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
319-2 (II) Classify simple acids, bases, and salts on the basis of their names and formulas. Name and write formulas for some common acids and bases using the periodic table, a list of ions, and rules for naming acids. 321-2 Describe how neutralization involves tempering the effects of an acid with a base and vice versa. 212-8 Evaluate and select appropriate instruments for collecting evidence and appropriate processes for problem solving, inquiring, and decision making by investigating the properties of acids, bases, and salts.	Students should know the formulas of some common acids [e.g. $HCl_{(aq)}$, $H_2SO_{4(aq)}$, $HNO_{3(aq)}$], bases [e.g. NaOH, $Ca(OH)_2$] and salts [e.g. NaCl, CaO, $CaCO_3$]. They should also be introduced to the rules for writing and naming common acids. Students should illustrate the neutralizing properties of calcium oxide (lime) by reacting it first with water (thus making the base calcium hydroxide) and subsequently with dilute sulphuric acid. This would simulate neutralizing a lake that has been affected by acid precipitation. Alternatively, other combinations of acids and bases could be used. Check the pH with either pH paper or a pH meter as you proceed with each step. Electronic equipment such as CBLs or Sense and Control units could also be used here if available. Students should determine the presence of an acid, base, salt, carbon dioxide and water by performing tests with pH paper, limewater, cobalt chloride paper, and a conductivity apparatus. If electronic equipment such as graphing calculators, pH sensors, CO_2 sensors, etc. are available, their use should be encouraged at this point. Students could test common substances in the home to see if they are acidic, basic, or neutral. A microscope could also be used with a paramecium culture to dilute sulphurous acid to see the effects of acid rain on microorganisms.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Discussion Discuss the relevance of acids and bases in our everyday lives. Health: exercising, digestion, dental care, bulimia nervosa, ulcers, cosmetics, and baking Environment: effects of acid rain on architecture, scrubbers, fish, amphibians, forestry, and agriculture Industry: the number one industrial chemical used in North America is Sulfuric Acid. It is used in processes involving dissolving metals. *Demonstration* Mix equal concentration and amounts of acid and base to neutralize and produce table salt and water. *Activity* Have students do the taste tests as described in the activity on page 107 in the student text. *Activity* Have students explore the web site www.Science.Nelson.com to find a listing of the top 50 industrial chemicals and to classify them as an acid, a base, a salt, or another type of substance.	**Nelson, *Science 10-Concepts and Connections***, pages 104-105 **Nelson, *Science 10-Concepts and Connections,* Student Record of Learning**, pages 154-156 *Sciencepower 10*, pages 210-236 *Science 10*, pages 288-295 *Science 10, Applied Supplement*, Applied Blackline Master 8.4 *Science 10*, Chemical Processes Blackline Masters 8.1, 8.3, and 8.4 **Nelson, *Science 10-Concepts and Connections***, pages 106-107 **Nelson, *Science 10-Concepts and Connections, Student Record of Learning***, pages 157-159 *Science 10*, pages 196, 198 *Science 10, Chemical Processes* Blackline Master(s) 5.5 *Sciencepower 10*, Blackline Masters 7-1, 7-2, 7-3, 7-4 *Science 10, Applied Supplement*, Applied Blackline Master 8.3 *Science 10*, pages 322-323 *Sciencepower 10*, pages 254-255, Investigation 8C *Sciencepower 10*, Blackline Master 8-3 *Science 10*, page 317 *Science 10, Applied Supplement*, Applied Blackline Master 8.9

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
213-5, 214-5 Compile and organize data on acid precipitation (pH) in order to interpret patterns and trends in these data, and infer or calculate linear and nonlinear relationships among variables such as pH versus time and location. 116-5, 215-6, 116-3 Work co-operatively with a team to research and describe the relationship between domestic and industrial technologies and the formation of acid rain. 214-15, 118-5 Propose alternative solutions to the problem of acid precipitation, assess each and select one as the basis for a plan of action, defending the decision. 117-1 Compare examples where society has used the presence of airborne pollution to influence decisions concerning science and technology. 117-7 Identify and describe science and technology based careers related to acid/base pollution.	Use Internet sites and e-mail to contact other areas which are associated with acid precipitation. Use this information and library research to write a balanced (i.e. presenting all sides) report on the subject based on information gathered. Which includes references to causes, possible remedies, and the career potential for people working in this field. Students should defend their position with relevant arguments from different perspectives and include examples of how society supports and influences science and technology. They should also identify examples where technologies were developed based on scientific understanding.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Research Have students gather water samples from different areas and measure Ph over a period of time. Graph the results and discuss reasons for variations such as air currents and precipitation levels. *Discussion* Have students explore the issue "Is pollution necessary?"	**Nelson, *Science 10-Concepts and Connections***, pages 114-117 **Nelson, *Science 10-Concepts and Connections, Student Record of Learning***, pages 174-177 *Sciencepower 10*, pages 264-266 **Nelson, *Science 10-Concepts and Connections,*** pages 118-119 **Nelson, *Science 10-Concepts and Connections,* Student Record of Learning**, pages 178-181 *Sciencepower 10*, Blackline Masters 8.5 and 7.6 *Science 10*, pages 248-249 and 322-323 *Sciencepower 10*, pages 274-275 *Science 10*, pages 308-313 and 328-329 *Science 10*, pages 322-323 *Science 10, Applied Supplement*, Blackline Master 7.8
Explore Have students review Courses of Study in the field of Environmental Science which is offered at colleges and universities. What high school courses are required to enter these programs? *Discussion* Have students discuss their own career goals and how they may relate to the environment.	Calendars from Colleges and Universities as well as internet searches Guidance Counsellors *Science 10*, Teacher's Resource 8.13

Science 431A

Unit 3

Physics

Physics: Unit Overview

Introduction

The concept of motion allows students to investigate and develop their interest in the sports that are part of their daily lives. Students will not only have opportunities to investigate the principles of kinematics but will also be encouraged to apply its development into areas of individual interest. Whether they choose Olympic sports events or personal leisure activities such as snowmobiling or biking, students will develop their understanding of the concepts of displacement, velocity, and acceleration.

Focus and Content

The unit on motion should have two principle focuses- **inquiry** and **problem solving**. Students will be able to examine questions which inquire into the relationships between and among observable variables that affect motion. Once these relationships are understood, design investigations can begin to address the problems associated with those questions. By applying mathematical and conceptual models to qualitative and quantitative data collected, motion can be graphically represented. This will provide a visual representation of aspects of velocity and acceleration. Mathematics and graphical analysis allow us to see basic similarities in the motion of all objects. In addition, the unit provides opportunities to explore decision making as the students investigate the developments in design technology.

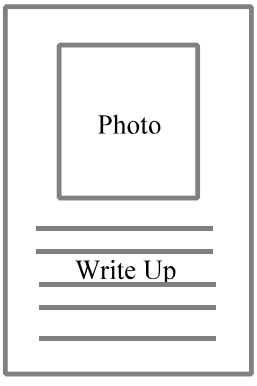
Curriculum Links

Prior to grade 10, the study of motion receives little depth of treatment. Indirect connections are found with “Forces and Simple Machines” in Grade 5 and “Flight” in Grade 6. The study of motion will also develop a strong link to Mathematics in Grades 9 and 10 where Data Management includes the collection, display, and analysis of data.

Physics: Specific Curriculum Outcomes for this Unit

STSE	SKILLS	KNOWLEDGE
Nature of Science and Technology 114-3 Evaluate the role of continued testing in the development and improvement of technologies. 114-6 Relate personal activities and various scientific and technological endeavours to specific science disciplines and interdisciplinary studies. 115-1 Distinguish between scientific questions and technological problems. 115-4 Describe the historical development of a technology. **Relationships between Science and Technology** 116-7 Analyze natural and technological systems to interpret and explain their structure and dynamics. **Social and Environmental Contexts of Science and Technology** 117-8 Identify possible areas of further study related to science and technology. 117-10 Describe examples of Canadian contributions to science and technology. 118-3 Evaluate the design of a technology and the way it functions on the basis of identified criteria such as safety, cost, availability, and impact on everyday life and the environment.	**Initiating and Planning** 212-4 State a prediction and hypothesis based on available evidence and background information. 212-6 Design an experiment and identify specific variables. 212-7 Formulate operational definitions of major variables. 212-9 Develop appropriate sampling procedures. **Performing and Recording** 213-3 Use instruments for collecting date effectively and accurately. 213-4 Estimate quantities. **Analyzing and Interpreting** 214-5 Interpret patterns and trends in data, and infer or calculate linear and non-linear relationships among variable. 214-8 Evaluate the relevance, reliability, and adequacy of data and data collection methods. 214-10 Identify and explain sources of errors and uncertainty in measurement, and express results in a form that acknowledges the degree of uncertainty. **Communication and Teamwork** 215-2 Select and use appropriate numerical, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results.	325-1 Describe quantitatively the relationship among displacement, time, and velocity. 325-2 Analyze graphically and mathematically the relationship among displacement, time, and velocity 325-3 Distinguish between instantaneous and average velocity. 325-4 Describe quantitatively the relationship among velocity, time, and acceleration.

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
215-2 Devise a method of representing the linear motion of two moving people or objects. 117-8 Identify areas of further study related to science and technology. 114-6 Relate a research project on motion to studies on specific science disciplines and interdisciplinary studies. 115-4 Describe the historic development of a motion technology.	Help students understand new terms and organize their own learning. Students will explore various forms of motion by making a collage. Point out: linear, circular, constant versus changing, position, velocity, and acceleration. Identify possible scientific careers related to motion i.e. sports training, mechanical engineering, aerodynamic, and ballistics. Relate common personal knowledge the students have of scientific motion - how and why things move. Use historical development of a type of travel to see and understand the scientific advances of technology and see why technology is changing.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Journal Begin a journal as a dictionary of terms. The journal should include terms such as: position, distance, displacement, motion, speed, velocity, acceleration, vector, scalar, slope, average, instantaneous, uniform (constant) and relative velocity, accuracy, precision and rounding. It should include the following types of velocities: average velocity, instantaneous velocity, uniform (constant) velocity, and relative velocity. Complete the definitions throughout the unit. In small groups, students prepare a collage of various forms of motion. Using resources from the school counsellor, have students choose and research a career related to motion and briefly summarize it. *Communication* Brainstorming Technology Activity Brainstorm technologies required to move on our planet under different conditions. Then consider space travel and what conditions would be different, such as lack of friction and oxygen and less gravity. *Research and Written Assignment* Students will pick a mode of transportation and research the development of this vehicle from the design aspects such as what prompted change, i.e. desire for speed, safety standards, aerodynamics, longevity, reliability, function, cost, environmental impact, new technologies.  Prepare as a pictorial report, (approximately five pages of information) mention topics like aerodynamics, ergonomics, environmental science.	*Science Power 10*, pages 296-297 Students can find pictures from books, magazines, encyclopaedias (CD-Roms), Internet and drawings. *Science 10*, page 374 *Science 10*, Applied Blackline Master 12.11 **Nelson, *Science 10-Concepts and Connections***, page 177 Use encyclopaedias, (CD- Roms), Internet *Science 10*, pages 380-381 **Nelson, *Science 10-Concepts and Connections***, Case Study, pages 158-159 *Science Power 10*, pages 284-294 Use encyclopaedias, (CD- Roms), Internet *Science 10*, Applied Blackline Master 10.1, 3.63 and 3.64 *Science Power 10*, Blackline Master 9.8 *Science 10*, Applied Blackline Master 10.6, 3.71

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
325-1, 212-7 Describe quantitatively the relationship among distance, time, and average speed of an object's linear motion. 214-10 Identify and explain sources of errors and uncertainty in distance, time, and speed measurements and express results in a form that indicates the limits of accuracy.	Lecture: Teacher will present concepts of position, displacement, time, velocity and speed. Also include units and formulas. Using formulas for speed, velocity, and displacement work on solving for unknown variables. An example is solving $V = \frac{d}{t}$, for t. Make sure students use proper units. Discuss the difference between accuracy and precision and the need for significant figures to reduce the chance of error. Relate this back to how to round answers from previous problems. Example: dartboard analogy • accuracy is how close you get to the bulls eye • precision is repeated hits of the same spot Point out that in physics we deal with real measured data. No instrument can read down to an infinite number of decimal places. The last digit always contains some error as it is an estimate. Show that scientific notation is used in combination with significant figures to write numbers to reflect precision. You may need to review rounding and metric conversion.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Pencil/Paper Students take notes. Give example problems where students use formulas to solve for an unknown variable. Show how units can be used to help remember a forgotten formula. *Demonstration* Why we need significant figures to reduce error. Put a number like 4.7g on the board. Ask students what numbers would round to give you 4.7. The lowest one would be 4.65 and the highest would be 4.74. Put these into a formula similar to the following: $y = x^2$ and compare the answers $y = (4.65)^2 = 21.6225$ $y = (4.74)^2 = 22.4676$ Only the first two digits are close and the rest are irrelevant. Look at different instruments used to measure distance, time, and velocity. Compare the precision of each instrument. Show how an instrument could be very accurate but not precise and very precise but not accurate. *Measurement Lab* Set up 5-8 work stations with things to measure and different tools used to measure the items. Students should compare their answers, relating to estimations, accuracy, and precision.	*Science 10*, pages 340-341 and 354-357 *Science 10*, Investigations 9.4, pages 352-353 *Science 10*, Determining Average Speed, pages 372-373 **Nelson, *Science 10-Concepts and Connections***, pages 136 and 146-153 *Science 10*, Transparency 9.2, page 41 *Science 10*, Applied Blackline Master 9.2A and 9.2B **Nelson, *Science 10-Concepts and Connections***, pages 140-141 Significant Figures and Scientific Notation are available on pages 139 and 140 of the appendix of this unit. *Science Power 10*, pages 305-307 *Science 10*, Career Profile on page 374

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
212-7 Formulate operational definitions of major variables. 325-3 Distinguish between instantaneous and average velocity. 215-2 Select and use appropriate numerical, symbolic, graphical, and linguistic modes of representation to communicate ideas, plans, and results.	Present Definitions: • scalar quantity • vector quantity Relate back to definitions of speed and velocity and position and distance which were already given. Present definitions: • average velocity • instantaneous velocity Introduction to Graphing Topics such as creating data tables, preparing graphs, x and y axis, labelling the axes, selecting appropriate scales to use, plotting points (x,y) coordinates. Differentiate between constant speed and average speed.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
*Pen/Paper*Add definitions to journal. Brainstorm examples of things that are measured and categorize them as a scalar or a vector quantity. (e.g. A concept map or table format) *Demonstration/Lab* *Activity:* A car on an inclined plane (leave out the concept of gravity) Measure average velocity $\frac{\Delta d}{\Delta t}$ of the trip. Activity: Use a map and its scale to measure average velocity $\frac{\Delta d}{\Delta t}$ of a trip. *Activity:* To determine an average speed, have students gather distance versus time data by travelling on a trip from Charlottetown to Summerside or from Summerside to Cavendish. Method: • set up appropriate time intervals (1 minute or 5 minutes) • at each time interval, record odometer reading • compile data in a table • graph data • determine average speed for the entire trip and for several time intervals • present speed graph to classmates to include average speed, instantaneous speed, and constant speed	**Nelson, *Science 10-Concepts and Connections***, pages 160-167 *Science 10*, pages 372-373 Science 10, Blackline Master 9.4 and 9.5A and B, and 9.5C and D *Science 10*, Transparency 9.6 *Science 10*, Blackline Master 9.6A and B *Science 10*, Blackline Master 9.6B *Science 10*, pages 360-361, Balloon Car Contest *Science 10*, pages 369-371, Average Speed on an Air Table *Concepts and Challenges in Physical Science*, revised Third Ed. Lab Program Globe Team, pages 41-42. (Incorporates measurement, constructing a data table and graphing data.)

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
325-2 Analyze graphically and mathematically the relationship among displacement, time, and velocity. 116-7 Analyze natural and technological systems to interpret and explain their structure and dynamics.	Distance - Time Graphs Slope of a distance-time graph is equal to velocity. Area under a velocity-time graph is equal to displacement.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Graphing Exercise: may need to create review sheets. Word problems on distance/time/velocity with data tables and graphing. Review and teach slope and area of triangles and trapezoids.	*Science 10*, (Skills Section in Appendix), pages 699-702 **Nelson, *Science 10-Concepts and Connections***, pages 154-157 *Science Power 10*, (Appendix), pages 600-604 *Science 10*, Transparency 9.7, page 43 *Science Power 10*, Blackline Masters Blackline Master 10.6 Applied Supplement Science 10 Blackline Master 9.7 and 9.7A *Science 10*, Slope of a Speed-Time Graph Blackline Master 10.4A *Science Power 10*, Blackline Masters Blackline Master 10.2, The Helicopter Challenge pages 198-199 Blackline Master 10.4, The Harness Race, pages 202-203

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
212-7 Formulate operational definitions of major variables. 116-7 Analyze natural and technological systems to interpret and explain their structure and dynamics.	Lecture - Notes • acceleration (non-zero net force causes acceleration) (acceleration due to gravity) Graphing: • velocity-time graphs • find slope which is equal to acceleration Linear Motion versus Circular Motion Analyze boat, car, windmill, engines, etc. to look for changes in direction of motion.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Brainstorm examples of acceleration (students will probably come up with the idea of deceleration or slowing down). Remind students that deceleration is not a proper term to use in physics. Negative acceleration is the proper term, although remembering that it doesn't always mean slowing down. *Activity:* What happens when an object accelerates? (experiment, measurement, data table) Acceleration Word Problem Worksheet Speed-time Graphs for Acceleration Investigation 10-10 Acceleration of Different Vehicles Buying a car 10.6 case study *Activity:* K'nex type project - switches from linear to rotational motion	**Nelson, *Science 10*-Concepts and Connections,** pages 178-181 and 184 *Concepts and Challenges in Physical Science*, pages 43-44 *Science 10*, Blackline Master 10.3D *Science 10*, Transparency 10.4, page 46 *Science 10*, pages 406-407 *Science 10*, Blackline Master 10.6, pages 396-397

Science 431A

Unit 4

Weather Systems

Weather Dynamics: Unit Overview

Introduction

Global climate and local weather patterns are affected by many factors and have many consequences. This unit asks students to consider questions such as: "What decisions do we face due to weather conditions?"; "How are our lives affected by changing weather conditions (short term) and changing climate (long term)?"; and "What causes these weather patterns?"

In Atlantic Canada weather patterns change frequently. Each season provides interesting weather conditions that influence how we dress, how we feel physically and psychologically, and how we interact socially. The direction from which air masses move and the atmospheric pressures and temperatures in those air masses contribute to changes that can be quite significant in any given season. Rapid temperature rises in spring may cause significant snow melt; clear and dry weather in summer raises the risk of grassland and forest fires; autumn sees the arrival of storms from the Caribbean; winter snowfall and temperature variations depend upon the north/south drift of the atmospheric jet stream. These changes influence Atlantic Canadians in a variety of ways.

Focus and Context

By considering questions that you and your students generate, various learning and assessment activities will meet specific curriculum outcomes. Although this unit focuses on **decision-making**, there are opportunities for **observation and inquiry** as well as **problem-solving and design technology.** Sections in the unit ask students to consider heat energy and its transfer, energy exchange within and between systems, observing weather data and the impact of weather forecasting.

Curriculum Links

Weather Dynamics connect with other clusters across many grade levels such as: "Daily and Seasonal Change" (Grade 1); "Air and Water in the Environment" (Grade 2); "Weather" (Grade 5) which includes the water cycle, changes in air caused by heating, and patterns of change in local conditions. "Heat" (Grade 7) includes temperature and its measurement, methods of heat travel, the particle model of matter, and qualitative treatment of heat capacity. "Water Systems on Earth" (Grade 8) links ocean currents to regional climates and the influence of polar ice caps. This unit will support optional studies in Grades 11-12 such as: Life Science - "Interaction of Living Things"; Chemistry - "Thermochemistry"; Physics - "Force, Motion, Work", "Energy, Momentum and Waves"; Earth and Space Science - "Earth Systems and Processes". Prior to Grade 10, students will also have considered weather and climate in our region through the social studies curriculum introduced in 1998.

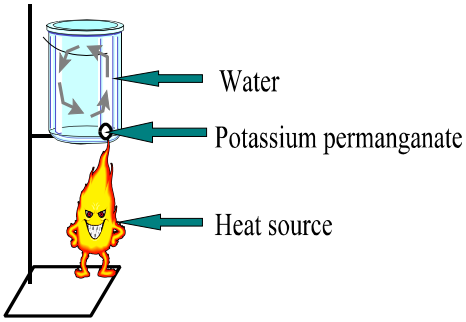
Weather Dynamics: Specific Curriculum Outcomes for this Unit

STSE	SKILLS	KNOWLEDGE
Nature of Science and Technology 114-6 Relate personal activities and various scientific and technological endeavours to specific science disciplines and interdisciplinary studies. 115-2 Illustrate how science attempts to explain natural phenomena. 115-6 Explain how scientific knowledge evolves as new evidence comes to light. **Relationships between Science and Technology** 116-1 Identify examples where scientific understanding was enhanced or revised as a result of the invention of a technology. **Social and Environmental Contexts of Science and Tech.** 117-6 Analyze why scientific and technological activities take place in a variety of individual and group settings. 117-10 Describe examples of Canadian contributions to science and technology. 118-2 Analyze from a variety of perspectives the risks and benefits to society and the environment of applying scientific knowledge or introducing a particular technology. 118-7 Identify instances in which science and technology are limited in finding the answer to questions or the solution to problems.	**Initiating and Planning** 212-1 Identify questions to investigate that arise from practical problems and issues. **Performing and Recording** 213-2 Carry out procedures controlling variables and adapting or extending procedures where required. 213-3 Use instruments effectively and accurately for collecting data. 213-6 Use library and electronic research tools to collect information on a given topic. 213-7 Select and integrate information from various print and electronic sources or from several parts of same source. **Analyzing and Interpreting** 214-10 Identify and explain sources of error and uncertainty in measurement and express results in a form that acknowledges the degree of uncertainty. 214-11 Provide a statement that addresses or answers the question investigated in light of the link between data and the conclusion. **Communication and Teamwork** 215-5 Develop, present and defend a position or course of action based on findings.	331-1 Describe and explain heat transfer within the water cycle. 331-2 Describe and explain heat transfer in the hydrosphere and atmosphere and its effects on air and water currents. 331-3 Describe how the hydrosphere and atmosphere act as heat sinks within the water cycle. 331-4 Describe and explain the effects of heat transfer within the hydrosphere and atmosphere on the development, severity, and movement of weather systems. 331-5 Analyze meteorological data for a given time span and predict future weather conditions, using appropriate methodologies and technologies.

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
114-6 Relate personal activities and technology used with meteorology in the design of a weather station. 115-6 Explain how scientific knowledge evolves as new evidence comes to light. 213-6, 213-7 Use print and electronic sources to collect weather data from regional and national weather observational networks. 214-3 Compile and display evidence and information, by hand or by computer, in a variety of formats. 331-5 Analyze meteorological data for a given time span.	Ask students to make a table with headings: "know" and "want to know" to raise their awareness of the topic of weather. This information can be used to develop a concept map for the whole class. Once it has been taught, ask students to complete the "have learned" column of the table. A log book of weather data should be started so that students will have data to analyze later on. Building weather stations is a great learning activity for students. Teachers may prefer to assign building weather stations at the beginning of the unit or at the end.

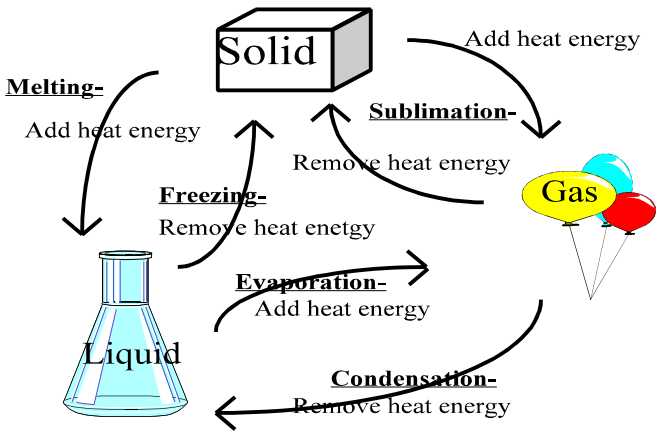
Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Group Activity Weather and Climate Know | Want to know | Have learned *Pencil/Paper and Technology* Each student collects information for a period of 5-10 days on topics such as: • temperature • wind speed • relative humidity • barometric pressure • wind direction • wind chill • precipitation • cloud cover • dew point Use this information to plot a graph, create a table, or other methods of displaying collected data. This could be done as a group project and then presented to the class.	**Nelson, *Science 10*-Concepts and Connections**, page 195 • internet • newspaper • radio • telephone • television *Sciencepower 10*-Science, Technology, Society, and Environment videotape modules *Sciencepower 10*, pages 599-605 *Science 10*, pages 699-702 **Nelson, *Science 10* - Concepts and Connections**, pages 198-201 **Nelson, *Science 10* - Concepts and Connections**, pages 202-203 (Building a Weather Station)

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
331-1 Describe and explain heat transfer within the water cycle. 213-2 Carry out procedures controlling variables and adapting or extending procedures where required. 214-3 Compile and display evidence and information, by hand or by computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots.	Introduce thermal energy and heat transfer. Classify examples of heat transfer as convection, conduction, or radiation.

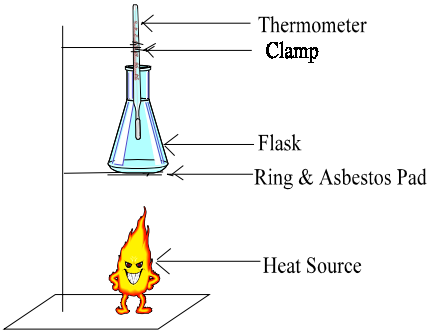
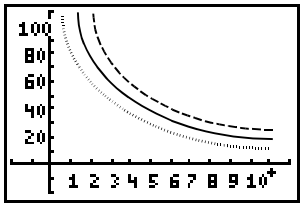
Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Demonstration/Activity - depending on level of students Convection, conduction, and radiation can be demonstrated and understood by having students complete the following lab:  Observe convection currents in water as the $KMNO_4$ rises. *Activity* Solar Oven - students can build and use a solar oven. They can cook smores, nachos with cheese, and even hot dogs if the sun is really hot. Also, students can observe: • radiation by feeling the heat radiate in all directions • convection in air by observing heat waves rising • conduction because the top of the beaker is hot Class can brainstorm examples of convection, conduction, and radiation. Demonstrate expansion using a ball and ring. Other discussions may include the angle of the sun and the seasons of the year for radiation.	*Sciencepower 10*, pages 422-424 *Science 10*, pages 504-506 internet search on solar ovens http://solarcooking.org/ *Science 10* Applied Blackline Master 13.7 *Science 10*, pages 508-509

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
331-2 Describe and explain heat transfer in the hydrosphere and atmosphere and its effects on air and water currents. 331-1 Describe and explain heat transfer within the water cycle.	Teachers may wish to teach Section 4.11 on page 222 on the atmosphere before doing this lesson. The right side of Figure 4 on page 223 has the temperatures missing. The ranges are listed below: Troposphere 20° C to -50°C Stratosphere -50°C to 10°C Mesosphere 10°C to -75°C Thermosphere -75°C to 30°C To understand the water cycle as it relates to thermal energy, the following concepts will be covered: • changes of state due to the addition/removal of thermal energy • melting point • boiling point • boiling versus evaporation versus transpiration • condensation • cloud formation and condensation nucleus • precipitation (temperature effects)

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources

Pencil/Paper
Adding heat energy and removing heat energy contribute to changes of state.
 
 	
<u>Cloud formation</u>
• the role of condensation nuclei
  • boiling usually happens on edges/surfaces- eg: throwing a tea bag into micro waved water
• three mechanisms of cloud formation
 	
Demonstration/Activity
Cloud in a Bottle - directions on page 155 of the appendix- Take the label off a plastic water bottle, drain it leaving a few drops, and twisting the bottle back and forth vigorously with the lid tightened securely. Holding the twisted bottle in one hand, gently twist off cap. If done correctly, the cap will explode and fly across the room. The combination of moisture, heat energy, and pressure gives you a hot "smoke", thus a cloud in a bottle.
 	
  • classifying clouds
 	
<u>Precipitation</u>
 	
  • explain how the air/surface temperature determines the type of precipitation
	Sciencepower 10, page 434
	
	Science 10, page 523
	
	Nelson, *Science 10 -Concepts and Connections*, pages 216-217
	
	Activity "Condensation Nuclei"
	Sciencepower 10, page 487
	(Note: to avoid breakage of beaker, heat very slowly or use a tin can.**)**
	
	Sciencepower 10, page 488
	
	Science 10, page 530-531
	
	Sciencepower 10, a jar full of clouds, page 485
	
	Blackline Master 15.1
	
	Science 10, page 532-533
	
	Science 10, overhead # 69
	
	Science 10, Blackline Master 13.11B - for evaluation
	
	Sciencepower 10, page 489-492
	Blackline Master 15.2
	
	Nelson, *Science 10 -Concepts and Connections*, pages 228-229
	
	Each teacher should have a set of coloured overheads showing different types of clouds.
	
	Sciencepower 10, page 494 and Blackline Master 15.3
	
	Science 10, page 556 and overhead # 72

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
212-1 Identify questions to investigate that arise from considering the energy transferred within the water cycle. 331-4 Describe and explain the effects of heat transfer within the hydrosphere and atmosphere on the development, severity, and movement of weather systems.	Specific heat capacity (SHC) - encourage students to understand SHC by completing a lab. Nearby water moderates the climate of an area. Onshore and offshore breezes. Describe examples of how water's high SHC (specific heat capacity) influences local weather patterns.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Activity Dry Air and Water Activity  1. Heat the air in a 600 mL flask to approximately 94.5˚C. *Make sure to remove the heat source before the thermometer gets above 94˚C. Wait a minute or so and record the highest temperature (usually goes to 100˚C). 2. Record the initial temperature of the air and then the air temperature every minute for a period of time (15-20 minutes). 3. Conduct the same activity using 150 mL of water in the flask. Bring the water to a boil. Record the initial temperature and then record the temperature every minute for a period of time. * If you want students to be able to understand how surface area affects temperature change, half of the groups could use a beaker for the water (150 mL).  *Collect Data* Have students draw a graph showing the relationship between time and temperature. Use markers to identify each: air water in flask, water in beaker, etc. *Technology* Use the Stat-Plot Function on the graphing calculator to represent the data. *Demonstration* Fill a balloon with air and another with 20 mL of water. Using a match place a flame under the air balloon first - it will pop immediately. Place the flame under the balloon with water - it will not pop. This demonstrates water's high specific heat capacity. *Investigation* How do the interactions between ground, water, and air result in wind?	*Sciencepower 10*, page 427 *Science 10* page 506-507 **Nelson, *Science 10* - Concepts and Connections**, pages 10-11 Applied Blackline Masters 13.2 and 4.58 *Sciencepower 10*, page 430, Fig. 13.7, A and B *Sciencepower 10*, page 441 *Science 10*, page 554 *Sciencepower 10*, pages 455-456 *Science 10*, page 508 *Sciencepower 10*, page 440

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
331-3 Describe examples that illustrate that the atmosphere and hydrosphere are heat sinks in the water cycle. 115-6 Explain scientific knowledge evolves as new evidence comes to light. 331-4 Describe and explain the effects of heat transfer on the development, severity, and movement of weather systems. 116-1 Identify examples where scientific understanding was enhanced or revised as a result of the invention of a technology. 115-2 Illustrate how science attempts to explain seasonal changes and variations in weather patterns for a given location.	Students will realize that both the atmosphere and hydrosphere will act as heat sinks. This stored energy causes many weather systems. For example, the Greenhouse Effect. Students may synthesize the concepts of heat transfer, water's role as a heat sink, and the different densities of air and water to see how currents are formed when air and/or water are heated unequally. For example: onshore and offshore breezes. Greenhouse Effect is an example of storing heat in the atmosphere. Students will understand that the proximity to the sun is not the determining factor in our seasons. Rather, it is the tilt of the Earth. Note that some materials incorrectly show the sun at the centre of the Earth's orbit and/or the Earth traveling in a circular orbit. In the Northern Hemisphere, the Earth is actually closer to the sun in the winter. * Global Winds The uneven heating of the Earth causes global winds. Coriolis effect causes rotation of winds.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Lab Activity Modelling a thermal inversion: Show how heat stored in water is transferred. This lab could also be used in the Wind and Water Current section. Students note that different materials can store different amounts of energy which may be released at a later time. *Technology* Explore how the amount of energy received at a surface depends on the angle of the light rays striking the surface. *Activity* Use Styrofoam balls and knitting needles as miniature Earths. Teachers should have a globe or miniature globes for students to see the movement of air over the Earth. An old record player can demonstrate the rotation of the Earth causing the Coriolis effect. *Pencil/Paper* Use graph paper and a flash light to show that when light hits the graph paper at an angle, as compared to straight on, it spreads out to cover a larger area. *Work Stations* See page 159 of the Appendix for a Weather Stations Lab.	*Sciencepower 10* Applied Course, Blackline Master 13.2, Activity 4, page 127 and Activity 5, page 128 *Science 10*, page 506 *Science 10*, page 625 and Applied Blackline Master 16.2 from *Science 10* Applied Supplement. Overhead 79 *Science 10*, page 506, figure 5 *Sciencepower 10*, page 441 *Science 10*, page 554 Activity page 509 in *Science 10*, using photometer instead of voltmeter? Each school has one with the graphing calculator. *Science 10*, overhead 64 **Nelson, *Science 10-Concepts and Connections,*** pages 226-227 and 230-231 *Science 10*, page 516-519 *Sciencepower 10*, page 462-468 *Science 10*, overheads 66 and 67 Appendix item “Science 431 - Weather Stations Lab” page 159 See page 157 of the Appendix for worksheet titled *How Earth’s Angle of Inclination and Curved Surface Influence the Global Heating Balance*

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
115-2, 331-2 Using scientific theory, describe and explain heat transfer and its consequences in both the atmosphere and hydrosphere, relating this science to natural phenomena. 214-3, 214-11 Compile and display data, using these to support conclusions, from experiments which investigate heat energy storage by, and heat exchange between, water and air masses.	Ocean Currents Note that land masses block the Coriolis effect in water. Interaction of air and water currents • El Nino (good videos available) • Jet Streams • Trade Winds Use students' previous experiences with water and its different states to relate how energy is transferred in the water cycle. Include ideas of transpiration and water as a waste product of respiration.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Lab Activity See resources *Research* Research a weather related fact that is caused by ocean currents, air currents, or the uneven heating of the Earth and explain using their knowledge of the above. Examples: • Why is the weather disrupted by El Nino every several years? • How does the Gulf Stream affect our climate and England's climate? • How are jet streams formed, and how do they affect our weather? *Activity* Create a trivia game for weather. *Visual Communication* After observing several different diagrams of the water cycle, have students put together their own diagram that includes the energy transfer in the water cycle through evaporation, transpiration, condensation, and precipitation.	*Sciencepower 10*, page 469-472 *Science 10*, overhead 68 *Science 10*, pages 612-614 *Sciencepower 10*, pages 475-479 *Sciencepower 10*, pages 466-467 *Science 10*, pages 518-519 and 614 *Sciencepower 10*, activity page 468 **Nelson, *Science 10-Concepts and Connections***, pages 234-235 **Nelson, *Science 10-Concepts and Connections***, page 195 *General Science Workbook*, page 24, section 11-4 *Science 10*, page 523, Lab page 524 and *Science 10*, Applied Blackline Master 4.63 *Sciencepower 10*, page 433- 434. **Nelson, *Science 10-Concepts and Connections***, pages 212-213 and Investigation, pages 216-217

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
331-2 Describe and explain heat transfer in the hydrosphere and atmosphere and its effects on air and water currents. 331-3 Describe how the hydrosphere and atmosphere act as heat sinks within the water cycle. 215-5 Develop, present, and defend a position or course of action based on findings. 114-6 Relate personal activities and various scientific and technological endeavours to specific science disciplines and interdisciplinary studies. 118-2 Analyse from a variety of perspectives the risks and benefits to society and the environment of applying scientific knowledge or introducing a particular technology. 214-11 Provide a statement that addresses or answers the question investigated in light of the link between data and the conclusion. 115-6 Explain how scientific knowledge evolves as new evidence comes to light. 213-7 Select and integrate information from various print and electronic sources or from several parts of same source.	Students will be aware that the layers of the atmosphere are defined by temperature. They will look for reasons for the differences in heat. Example: bottom top troposphere --warm --cold - heated by the Earth at bottom stratosphere --cold --warm - ozone layer heats it mesosphere --warm --cold - no source of thermal energy with increasing height thermosphere--cold --warm - ionosphere absorbs solar radiation exosphere --optional Include the tropopause, if you wish - also optional. Students should be given the opportunity to discuss or write journals about the ozone layer or related topics. Students examine and analyze articles for and against CFCs and related chemicals.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Visual Communication Students graph altitude versus temperature for the atmosphere. They can also include pertinent facts about each layer, possibly including the height of clouds, where jets fly, height of satellites, the auroras, etc. *Discussion* Discuss the benefits of sun screen, sunglasses, and recent developments from this industry. Also discuss tanning beds versus tanning cream. *Technology* Using internet articles, have students analyze the decreased use of CFCs in industry. Why was this reduction necessary, and why was it resisted?	Layers: *Sciencepower 10*, pages 441-444 *Science 10*, page 510 *Science 10*, overhead 65 *Science 10*, Applied Blackline Master 13.4 **Nelson, *Science 10* - Concepts and Connections, pages 222-225** Ozone layer: *Sciencepower 10*, page 549 *Science 10*, pages 625-626 *Science 10*, overhead 78 and 79 *Sciencepower 10* Applied Course, Blackline Master 16.9 and 16.10 *Science 10* Applied Supplement and Blackline Master 16.2 **Nelson, *Science 10-Concepts and Connections***, pages 242-243

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
331-4 Describe and explain the effects of heat transfer within the hydrosphere and atmosphere on the development, severity, and movement of weather systems. 214-3 Compile and display evidence and information, by hand or by computer, in a variety of formats, including diagrams, flow charts, tables, graphs and scatter plots.	Air Pressure Students should understand the formation of air masses. <u>North</u> <u>South</u> <u>Land</u> dry/cold dry/warm <u>Water</u> wet/cold wet/warm Students should understand the development and movement of fronts and their relation to high and low pressure systems. Make sure students do not confuse high pressure with high temperature.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Activity Have students label a map with the following air masses: continental polar, maritime polar, continental tropical, and maritime tropical. (*Science 10*, Blackline Master 14-3 is a map of Canada)	*Sciencepower 10*, pages 479-480 *Sciencepower 10*, overhead *Science 10*, page 546 *Globe Fearon Concept and Challenges in Earth Science*, page 251, Skill Builder Activity **Nelson, *Science 10-Concepts and Connections***, pages 206-207 and 220-221
Activity Fronts: Have students draw diagrams of the four types of fronts and the movement of pressure systems associated with them. ➡ Warm ➡ Cold ➡ Stationary ➡ Occluded Highs and Lows: If you have an activity that works, pass it along to the curriculum committee. Have students build a barometer.	*Sciencepower 10*, pages 496-501 *Sciencepower 10*, overhead #71 *Science 10*, Applied Blackline Master 15.5 to 15.10, 15.12, and 15.13 *Science 10*, pages 547-548 *Sciencepower 10*, Investigation 16A, page 523 Appendix item "Weather Fronts" pages 150

SCO: By the end of Grade 10 students will be expected to:	**Elaboration - Instructional Strategies/Suggestions**
331-5 Analyse meteorological data for a given time span, and predict future weather conditions using appropriate methodologies and technologies. 213-3 Use instruments effectively and accurately for collecting data. 118-7 Identify instances in which science and technology are limited in finding the answer to questions or the solution to problems. 214-10 Identify and explain sources of error and uncertainty in measurement, and express results in a form that acknowledges the degree of uncertainty. 116-1 Identify examples where scientific understanding has been enhanced or revised as a result of the invention of a technology. 117-10 Describe examples of Canadian contributions to science and technology. 117-6 Analyse why scientific and technological activities take place in a variety of individual and group settings.	Weather Prediction and Forecasting Weather Forecasting Instruments Students should know which instruments are used to measure the following quantities: • precipitation • wind speed (anemometer) • wind direction (wind vane) • air pressure (barometer) • temperature (thermometer) • relative humidity (hydrometer or psychrometer) If students are unfamiliar with any of these concepts, especially air pressure or relative humidity, review at this time. Weather Forecasting Technologies A further understanding of gathering regional/global weather will be found by examining the uses of the following technologies: • Doppler Radar (Canadian) • Weather balloons • Weather Satellites • Weather Aircraft • Computers

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Activity Give students basic materials that they can use to build instruments to observe and measure the following weather data: • rainfall or precipitation • wind speed • wind direction See page 154 of the Appendix for Materials Needed for Building Weather Stations. *Discussion* Have students discuss the limitations of their homemade instruments. *Technology* Go to a weather site on the internet and observe satellite data and/or research the purpose and use of these technologies. Watch the Weather Channel to discuss and analyze what you see.	Weather Instruments *Sciencepower 10*, pages 518-528 **Nelson, *Science 10-Concepts and Connections***, pages 202-205 See appendix item on page 154 for a list of materials for "Building Weather Stations" **Nelson, *Science 10-Concepts and Connections***, Case Study, pages 208-209 *Science 10*, pages 570-571 *Sciencepower 10*, page 453 Relative Humidity *Sciencepower 10*, pages 431-432 *Science 10*, pages 558-563 **Nelson, *Science 10-Concepts and Connections***, pages 218-219 Weather Technologies *Sciencepower 10*, pages 528-531 *Sciencepower 10* Applied Supplement, 16-2, page 142 *Science 10*, pages 567-570

SCO: By the end of Grade 10 students will be expected to:	Elaboration - Instructional Strategies/Suggestions
214-3 Compile and display evidence and information, by hand or by computer, in a variety of formats, including diagrams, flow charts, tables, graphs, and scatter plots. 331-5 Analyse meteorological data for a given time span and predict future weather conditions using appropriate methodologies and technologies. 115-2 Illustrate how science attempts to explain natural phenomena. 115-6 Explain how scientific knowledge evolves as new evidence comes to light.	Have students tabulate and graph meteorological data. Introduce weather map symbols used by meteorologists around the world. Have students analyse meteorological data and make weather predictions. Investigate various forms of severe weather.

Worthwhile Tasks for Instruction and/or Assessment	Suggested Resources
Pencil/Paper Have students create graphs and tables using student-collected information. *Activity* Analyse regional and national weather data including weather maps and tables. *Discussion* Predict future weather conditions based on information collected from a variety of sources. *Research* Research information on severe weather and give a presentation to the class. *Learning Stations* Each learning station could include information about different types of severe weather.	*Science 10*, Skills Handbook, page 699 *Sciencepower 10*, pages 599-605 **Nelson, *Science 10-Concepts and Connections***, pages 270 and 290-292 *Sciencepower 10*, pages 532-535 and 576 *Science 10*, pages 681-685 *Sciencepower 10*, Blackline Master, pages 436-438 Newspapers, internet, and The Weather Channel *Science Power 10*, Blackline Master, pages 439-441 *Science 10*, Blackline Master 14.8 and 14.11 *Science 10*, pages 550-551 and 564-573 *Sciencepower 10*, pages 537-542 *Science 10*, Applied Blackline Master 14.10 Newspapers, internet, and The Weather Channel *Science 10*, Blackline Master 15.1 A and B, 15.2, 15.3 *Science 10*, pages 594-610 *Sciencepower 10*, pages 502-512 Internet

Appendix

Appendix Unit 1

Ecosystems

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11. Owl Pellets 122

SCIENCE 431 WEBSITES

http://www.discovery.com Click on Puzzlemaker: here you can custom build a variety of puzzle types to match your curriculum.

http://www.freeworksheets.com As the name implies, it has a searchable database of free worksheets.

http://www.chemfiesta.com A great website that has lots of free chemistry worksheets for teachers.

http://www.speciesatrisk.gc.ca Provides information on Canada's threatened, vulnerable, extinct, and extirpated species.

http://solarcooking.org A website that has plans for building solar cookers as well as recipes. A great June or September activity if you have a hot sunny day. S'mores work great!

. . . .

www.thefutureschannel.com This Futures Channel Website has several links which offer short videos on several themes like the next two below.

www.thefutureschannel.com/movie_pages/water_supply.htm This website has a link which is a short video on where New York City gets its massive water supply.

http://www.thefutureschannel.com/science/index.html This website has a link which is a short video on growing plants with salt water.

http://www.wildeducation.org/thankyou.asp?navnum=3 Information on Project Wild with lots of links.

http://discovery.ca/ This website offers opportunities to explore with lots of links for projects and challenging puzzles.

http://cgee.hamline.edu/frogs/science/index.html Lots of photos of malformed anurans (frogs and toads).

www.speciesatrisk.gc.ca Large Environment Canada website with lots of information on Species at Risk.

http://www.EnchantedLearning.com/Home.html Lots of links to: animal printouts, biology label printouts, biomes, birds, butterflies, dinosaurs, mammals, plants, rainforests, sharks, and whales.

http://www.globalforestscience.org/homepage_flash.html "Cool articles" on forest science with reading levels around Grade 7 to 9. There is a field guide to the tree species of North American forests.

http://www.unesco.org/water/iyfw/ United Nations General Assembly proclaimed 2003 as the International Year of Freshwater. This site has links to worldwide resources on water.

Available from:
Confederation Centre Public Library
Telephone: 368-4642
Fax: 368-4652

Key to Levels:

P - Primary (grades K-3)	G - General
E - Elementary (grades 3-6)	A - Adults
J - Intermediate (grades 7-9)	T - Teachers
H - Senior High (grades 10-12)	U - University

Title: **Acid rain**

Call#:	VID 363.738 ACI PPR
Physical desc.:	1 videocassette (26 min.): sd., col.; ½ in.
Publisher:	Educational Media Company,
Date:	1993
Series:	Earth at risk environmental video series.
Level:	JH
Summary:	The effect of acid rain on outdoor statues is discussed. The program also explores the history of acid rain from the Industrial Revolution to its devastating effects on today's woodlands, aquatic ecosystems and wildlife. Energy alternatives that result in reduced acid rain are examined.

Title: **Biomes: Terrestrial ecosystems**

Call#:	VID 333.7 BIO PPR
Physical desc.:	1 videocassette (24 min.) Sound, Color; ½" GUIDE AVAILABLE
Publisher:	McIntyre Media Limited
Date:	1995
Series:	Environmental Video Series
Level:	JH
Summary:	Discover the what’s, where’s, and why’s of our planet's ecosystems - Biomes. With extraordinary examples from around the world, explore the delicate vegetation of the tundra, the amazing ecological adaptations of desert life, and the rich biologic diversity of tropical rain forests in this up to date video.

Title: **Clean Air**
Call#: VID 363.739 CLE PPR
Physical desc.: 1 videocassette (26 min.): sd., col.; ½ in.
Publisher: Educational Media Company,
Date: 1993.
Series: Earth at risk environmental video series.
Level: JH
Summary: This program examines environmental pollutants including ozone, carbon monoxide, sulfur dioxide, lead, and inside pollutants like tobacco smoke, formaldehyde, and asbestos that have led to the problem of air pollution.

Title: **Clean Water**
Call#: VID 363.737 CLE PPR
Physical desc.: 1 videocassette (26 min.): sd., col.; ½ in.
Publisher: Educational Media Company,
Date: 1993
Series: Earth at risk environmental video series.
Level: JH
Summary: This program examines the hydrological cycle, and the many ways that water is used, wasted, and polluted.

Title: **Degradation of the Land**
Call#: VID 363.739 DEG PPR
Physical desc.: 1 videocassette (26 min.): sd., col.; ½ in.
Publisher: Educational Media Company,
Date: 1993
Series: Earth at risk environmental video series.
Level: JH
Summary: This program examines the composition of topsoil and the micro-organisms that live there. A soil sample is measured for damage, ways to preserve topsoil are explored, and the need for a global policy to preserve land and control agricultural practices is emphasized.

Title: **Extinction**
Call#: VID 333.9 EXT PPR
Physical desc.: 1 videocassette (26 min.): sd., col.; ½ in.
Publisher: Educational Media Company,
Date: 1993
Series: Earth at risk environmental video series.
Level: JH
Summary: This program examines the causes of extinction, both natural and human, from the disappearance of the dinosaur to current efforts to protect animals.

Title:	**Global Warming**
Call#:	VID 363.738 GLO PPR
Physical desc.:	1 videocassette (26 min.): sd.,col.; ½ in.
Publisher:	Educational Media Company,
Date:	1993
Series:	Earth at risk environmental video series.
Level:	JH
Summary:	This program explains the greenhouse effect and its significance, the layers of the atmosphere, and the kinds of gases trapped there.

Title:	**Nuclear energy/Nuclear Waste**
Call#:	VID 363.72 NUC PPR
Physical desc.:	1 videocassette (26 min.): sd.,col.; ½ in.
Publisher:	Educational Media Company,
Date:	1993
Series:	Earth at risk environmental video series.
Level:	JH
Summary:	This program explains the parts of the atom and how scientists use fusion with uranium atoms to create energy, how a power plant works, how we dispose of nuclear wastes, and the different types of background radiation which humans are exposed to.

Title:	**The Ozone Layer**
Call#:	VID 363.738 OZO PPR
Physical desc.:	1 videocassette (26 min.): sd., col.; ½ in.
Publisher:	Educational Media Company,
Date:	1993
Series:	Earth at risk environmental video series.
Level:	JH
Summary:	Ozone molecules are examined, the need for an ozone/oxygen balance in the atmosphere is explained, the hole in the ozone layer over Antarctica is looked at, and UV radiation is measured.

Title:	**Photosynthesis**
Call#:	VID 570 PHO PPR
Physical desc.:	1 videocassette (60 min. - 6 programs, 10 min. each) Sound, Color; ½"
Publisher:	TVOntario
Date:	1989
Level:	HU
Summary:	Exciting 3-D computer animation shows the dynamic process of photosynthesis at the molecular level. Includes the following 6 programs: Seeing the Light; Absorbing the Light; The Light Reaction; The Dark Reaction; C3 and C4 Plants; The Fluid Transport System.

Title:	**The Rainforest**
Call#:	VID 333.75 RAI PPR
Physical desc.:	1 videocassette (26 min.): sd., col.; ½ in.
Publisher:	Educational Media Company,
Date:	1993
Series:	Earth at risk environmental video series.
Level:	JH
Summary:	This program demonstrates how the preservation of the rainforest is vital to the survival of our planet.

Title:	**Recycling**
Call#:	VIDEO COLLECTION VID 363.72 REC PPR
Physical desc.:	1 videocassette (26 min.): sd., col.; ½ in.
Publisher:	Educational Media Company,
Date:	1993
Series:	Earth at risk environmental video series.
Level:	JH
Summary:	Video examines our throw-away mentality and the vast waste management problems it has created. Video looks at "pre-cycling"and some other recycling choices.

Films

Eyewitness	Narrated by Martin Sheen 1995
	Vision - BBC Worldwide Americas
	Web http://www.dk.com
Each 30 minutes	1. Pond and River
(There are others)	2. Desert
	3. Ocean
	4. Arctic
	5. Jungle

Ecology Series (Compilation) 81 minutes

	NFB Land Above the Trees
Film library	NFB Intertidal Zone
10188080	NFB Temperate Rain Forest
	NFB Estuary
	NFB Wild in the City

Wetlands	Ducks Unlimited Canada
Touch Nature	Media Concepts for Prince Edward Island Tourism
In Touch with Nature	Media Concepts for Prince Edward Island Tourism
Touched by Tide (Bay of Fundy)	Film library 10115510 (rights)
Food for Thought	Every school has it through Agriscience

Science 431 Internet Assignment

INSTRUCTIONS

1. Open Netscape. In the address bar at the top, type in the following address: www.speciesatrisk.gc.ca

   Be sure to type in the address exactly as it appears above or it will not work.

2. Click on English as your language of choice.

3. On the left hand side of the window, click on the heading "Search Tools'. On the next page that appears, click on the words "species search" in the first paragraph. (They are in bold blue).

4. Select one of the species displayed (i.e. amphibian, birds, fish, mammals, reptiles, etc.) After you have selected one, click on the "Search" button at the bottom of the page.

5. You will be given a list of animals. Scroll down the list and select a species that interests you. You are now to answer each of the following questions on your animal. Place your answers on a piece of looseleaf which is to be handed in when you have finished the assignment.

QUESTIONS - WRITE YOUR ANSWERS NEATLY

1. State your animal's Latin Name, Taxonomic group, and range. (The range will give the initials of the province where your animal is found.)

2. Give a detailed description of your animal (ie. what it looks like, size, colouration, any special features).

3. Under the biology heading, find and answer each of the following:
   What is the animal's home range, habitat, feeding patterns, number of young produced, its predators, and its prey.

4. List any threats to the animal and what protection is being offered.

   Now go back to the list of animals and select a second animal.
   Answer the same four questions above for this animal.
   Hand in you assignment when finished.

Soil Composition and Erosion Experiment

Students will examine soil composition from the following experiment:

Experiment

Soil composition and erosion
2 Samples: Sample 1: - full of humus
Sample 2: - clay based

salt shakers full of water
tilt containers of soil (shallow tray)
sprinkle “rain” over samples
run off from sample 1 was minimal and filtered clean
run off from sample 2 was full of silt and abundant

Rainforest Debate

Name _____ Date _____

Purpose

- to introduce current issues surrounding the ancient temperate rainforests of the Pacific Northwest.
- to encourage students to consider the needs of a variety of different groups when discussing an environmental issue.
- to provide a forum for presenting ideas and opinions
- to encourage cooperative group work
- to involve students in considering how natural resources can be used in a sustainable way

Role Play Group
_____
_____

Notes:

Situation:

A logging company, TreeCut, has asked the government for permission to cut an area of the ancient temperate rainforest called Orca Sound. Many Groups will be affected by this decision and have asked the government for an opportunity to present their views about the logging proposal in a debate. At the end of the debate, the government will vote whether or not to allow logging in Orca sound and, if logging is allowed, what guidelines TreeCut will have to follow.

1. Explain to students that they will be asked to role play one of the groups that will be affected by the logging decision in a debate. They will be expected to tell the government whether they are for or against the logging proposal and why. It is important to explain that they are role-playing a point of view with which they may not agree, and that the purpose is to present all points of view involved in deciding how an ancient temperate rainforest should be used.

2. Divide the class into nine groups. Give each a role-playing card and allow them time to review their positions. The Government group should write down the different groups who will debate, whether they think each group will be for or against the logging plans, and one argument each group might present to support their position

3. For the debate, ask each group to choose one representative. Each speaker indicates whether the group is for or against the logging proposal, and why (1-3 minutes). Allow time for questions from other groups, or have an open question period in which any group may ask questions of any other group (10-15 minutes).

4. Each group gives a brief summary statement (30 seconds each).

5. Government makes a decision.

6. Discussion/feedback.

1	4	7
2	5	8
3	6	9

Rainforest Debate Discussion Questions

Name _____

Group _____ **Date** _____

- Why do you think that we had this debate?

- Before the debate, would you have voted for or against the logging proposal? Has your vote changed since the debate? Why or why not?

- Did you agree with the position of the group you were asked to role play? Why or why not?

- If you didn't agree with your group's position, how did it feel to present opinions with which you didn't agree? Should we consider the opinions of other groups, even if we don't agree with their position?

- If you were the government group, was your role a difficult one? Why or why not?

Rainforest Debate Role-playing Cards

Sea Kayaker	Restaurant Owner - Logging Town	Animals and Plants'of Orca Sound
You are planning a sea kayaking trip to the Orca Sound area next summer. You have heard about the logging plans and are against logging in the area as it will ruin your chance to experience the beauty of an ancient temperate rainforest. You were planning to spend a lot of money to fly to the Orca Sound area for your sea kayaking trip.	**You own a restaurant that has long been supported by loggers and their families. You support TreeCut's wish to cut the Orca Sound area. If it is not allowed, many of the loggers that eat in your restaurant may lose their jobs and may have to move from the area to find work. Without business from loggers, your restaurant may have to close.**	**The ancient temperate rainforest of Orca Sound is one of the few places remaining in the world where you can find your natural habitat. You believe that you have the right to shelter, food, clean water and space, and know that if Orca Sound is logged, particularly if the clear-cut method is used, your habitat will be destroyed and you will probably die. You are against the logging proposal.**

Logger	Native People of the Orca Sound Area	Government
You are the third generation of loggers in your family. You have three growing children to support and have worked for TreeCut for all of your working years. If TreeCut is not allowed to cut the Orca Sound area, you will most likely lose your job. You are not trained for any other type of job and work is hard to find around the community in which you live. You understand that environmentalists would like to save the old growth trees but you have to make a living in order for your family to survive.	**You are a member of the Nuu-chahnulth clan, whose people have lived in the Orca Sound area for thousands of years. You believe that the Orca Sound area rightfully belongs to your people and that you should have the final decision about what happens to the ancient temperate rainforest in your area. You respect the unique beauty of the forest but would consider some logging if the profits helped to improve life for your people.**	**You are a newly-elected government and depend on the support of both loggers and environmentalists in order to stay in office. You are being pressured by environmental groups, who believe that you can make a difference by preserving what remains of your province's ancient temperate rainforest, and by loggers, who fear that they will lose their jobs if logging is not allowed to continue in the ancient temperate rainforests. You need to make a decision, which may involve a compromise, at the end of the debate.**

Environmentalist	Inn Owner - Edge of the Ancient Temperate Rainforest	TreeCut Company
You are an environmentalist who has long been involved in trying to protect the ancient temperate rainforests of your province. You have seen logging companies in the past destroy large areas of the ancient temperate rainforest for profit and have seen the scars left by clear-cutting. You believe that replanting trees provides another crop of trees for the logging company to harvest and will never replace a true ancient temperate rainforest. You feel that the entire Orca Sound area should be protected from logging as it is a good example of an ancient temperate rainforest ecosystem.	**You own a small inn in the Orca Sound area that is often used by sea kayakers and people who hike a trail in the ancient temperate rainforest. If the Orca Sound area is logged, many of the tourists who stay in your inn will no longer have a reason to visit the area and you may have to close your inn.**	**You have been in the forestry business for over 50 years and have provided jobs for thousands of people in your province or state. Although you admit that some of the logging practices used in the past were irresponsible, you are taking steps to improve and try to replant cut areas whenever possible. Your company would lose money and would probably have to lay off some long-time workers if the government does not allow you to log Orca Sound.**

KEY into Forestry

Forest Puzzles

Feed Us!

There are seven animals listed on this page. Some of them are food for others. What else might be food? How about insects, dead leaves, nuts and seeds, and dead wood?

Arrange, the names of these living (and dead) things to show just who is eating whom. Add any others you wish.

Look at your arrangement, what does it tell you about the forest community?

A	F	R	O	G	S	N	C	L	T	F
H	C	L	C	M	O	U	S	E	C	C
W	A	R	T	C	W	T	A	L	O	N
O	N	B	X	U	L	R	L	O	M	T
R	O	E	I	C	L	I	A	I	M	L
M	P	E	O	T	O	E	M	R	U	O
S	Y	T	O	S	A	N	A	O	N	R
L	I	L	W	O	W	T	N	N	I	C
F	R	E	L	T	D	S	D	O	T	I
W	I	L	D	L	I	F	E	E	Y	Q
A	N	N	O	C	T	U	R	N	A	L

Find us!

(1) beetle
(2) canopy
(3) community
(4) frogs
(5) mouse
(6) nocturnal
(7) nutrients
(8) oriole
(9) owl
(10) salamander
(11) wildlife
(12) worms

Match us!

___ eats insects in trees
___ at the tree tops
___ come out at night
___ found under logs
___ needed for growth
___ eat dead leaves
___ depends on the forest
___ all living things in the forest
___ feeds on dead wood
___ hunts for mice
___ enjoys nuts and seeds
___ sleep during the winter

Forest Puzzle Answers

8	eats insects in trees
2	at the tree tops
6	come out at night
10	found under logs
7	needed for growth
12	eat dead leaves
11	depends on the forest
3	all living things in the forest
1	feeds on dead wood
9	hunts for mice
5	enjoys nuts and seeds
4	sleep during the winter

http://www.key.ca

Population Growth Rates

Concepts: carrying capacity
population growth rate
harvesting
maximum sustainable yield

Timing: any time of year

Introduction: Many organisms reproduce at a high rate, others do not. The carrying capacity, the ability of an environment to sustain species, affects the total population regardless of the population's reproductive rate. Many species that are harvested by humans never reach the environment's carrying capacity which can have repercussions for other species that depend on them. If humans harvest more individuals of a population than can be replaced in a reasonable amount of time (such as one life cycle of the organism, a year, or before the next harvest period) the population will decline. Precipitous declines may not allow recovery of the species' population unless harvest practices are changed. An example to discuss in class is shellfish harvesting off the east coast.

Objectives for students: The students will learn about managing populations of different types of animals to maintain a stable population size. Students will see the effects of over harvesting on populations and how different organisms can react differently to the same pressures. The activity also should show students how economics can determine some management decisions. They will also gain experience in mathematics.

Vocabulary: generation, harvesting, carrying capacity, population growth rate.

Materials: Each group requires a jar; three colours of poker chips (e.g., white, blue, yellow) or dried beans, enough of each colour to fill the jar at least twice; paper and pencil for recording data.

Activities:

1. Students should work in pairs or small groups. The jar represents the carrying capacity of the environment. The students fill the jar with one colour (white) of poker chips and count how many individuals can live in the environment.
2. Designate each colour as a different species with a different population growth rate. White chips double their population size every year. Blue chips double their population size every two years (or increase by 50% every year). Yellow chips double their population size twice a year (or once every six months). No population can be larger than allowed by the carrying capacity of the environment.
3. The students harvest half the white chips. How long will it take until the population size reaches the carrying capacity of the environment again? The students then harvest one quarter of the white chips. How long does it take for the population to reach the carrying capacity? The students then harvest three quarters of the population. How long until it reaches the carrying capacity this time?
4. For each harvest size answer: How often can the population be harvested if students wait until it reaches the carrying capacity before reharvesting? What happens if the population in harvested every year regardless of whether it reaches the carrying capacity or not?
5. Repeat steps 3. and 4. with the blue and yellow chips. What is the optimum harvest size if you wish to harvest once a year for each population? Twice a year? Once every two years? Compare between the three different populations.

Expansions:

1. Students should do a library research project on problems of the Peruvian Anchovy fishery or other fishing industry.

Who Wants to be an Environaire? Name:_____

Points ($)	Q _____ _____	
100	A	B
☺☺☺ ☺ 50 :50	C	D

Points ($)	Q _____ _____	
200	A	B
☺☺☺ ☺ 50 :50	C	D

Points ($)	Q _____ _____	
300	A	B
☺☺☺ ☺ 50 :50	C	D

Points ($)	Q _____ _____	
400	A	B
☺☺☺ ☺ 50 :50	C	D

Points ($)	Q _____ _____	
500	A	B
☺☺☺ ☺ 50 :50	C	D

Points ($)	Q _____ _____	
1000	A	B

☺☺☺	☺	50 :5 0	C	D

Points ($)		Q _____ _____	
2000		A	B
☺☺☺	☺	C	D
	50 :5 0		

Points ($)		Q _____ _____	
4000		A	B
		C	D

Points ($)		Q _____ _____	
8000		A	B
☺☺☺	☺	C	D
	50:50		

Points ($)		Q _____ _____	
16000		A	B
☺☺☺	☺	C	D
	50:50		

Points ($)		Q _____ _____	
32000		A	B
☺☺☺	☺	C	D
	50:50		

Points ($)		Q _____ _____	
64000		A	B

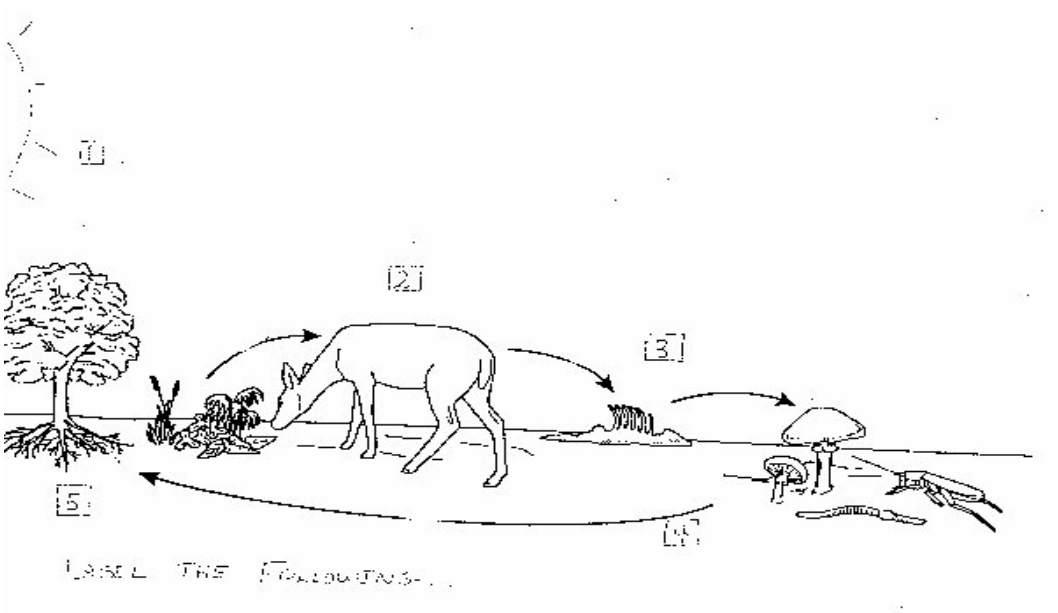
☺☺☺	☺	50:50	C	D

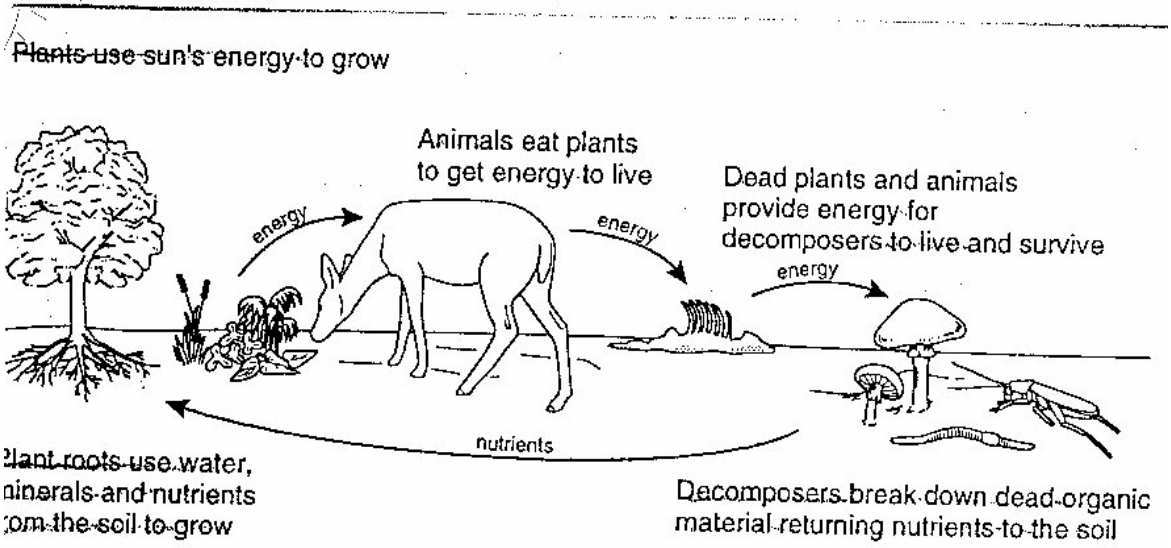
	Points ($)		Q _____	
	125000		A	B
☺☺☺	☺	50:50	C	D

	Points ($)		Q _____	
	250000		A	B
☺☺☺	☺	50:50	C	D

	Points ($)		Q _____	
	500000		A	B
☺☺☺	☺	50:50	C	D

	Points ($)		Q _____	
	1000000		A	B
☺☺☺	☺	50:50	C	D


[1]
[2]
[3]
[4]
[5]


Plants use sun's energy to grow
Animals eat plants to get energy to live
Dead plants and animals provide energy for decomposers to live and survive
energy
energy
energy
nutrients
Plant roots use water, minerals and nutrients from the soil to grow
Decomposers break down dead organic material returning nutrients to the soil

Owl Pellets - Small Group Activity

OVERVIEW: Owl pellets can be used to teach a part of the natural food chain. They can also be used to teach skeletal structure of rodents. Owl pellets are compact undigested parts which the owl eats. The owl regurgitates these compact pellets which contain fur, bones, etc. of small rodents. Dry pellets will not smell or be unpleasant for students to handle.

PURPOSE:

1. To teach a part of the natural food chain.
2. To teach skeleton parts by comparison.

OBJECTIVES: Students will be able to:

1. Identify a food chain sequence.
2. Classify pellet parts.
3. Compare, identify, and record the rodent skeletal parts to a rodent skeletal diagram.
4. Compare, identify, and record the rodent skeletal parts to a human skeletal diagram.
5. Construct a rodent skeleton from the skeletal parts found in the pellet. (Note: Skeleton may not be complete in each pellet.
6. Compare and record owl pellets from various states if available.

RESOURCES/MATERIALS: paper plate -1 per student, sharp dissecting tweezers -1 per student, owl pellets-can be shared within a group, copy of rodent skeletal system -1 per student, copy of human skeletal system -1 per student, pencil and paper to record results.

ACTIVITIES AND PROCEDURES:

1. Dissecting tweezers can be sharp and dangerous unless they are used carefully. Brainstorm do's and don't's on the board so everyone realizes expectations. This is very important when used at the elementary level.
2. Distribute copies of the rodent and human skeletons. Explain this will be used to identify bones.
3. Distribute paper plates. This will be used by the student to separate the pellet into various categories such as all skulls go into one area, all rub bones into another area.
4. Distribute owl pellet. Each pellet can be pulled apart within the group to be shared.
5. Students take it from here. Separate carefully so small rib bones aren't broken.

6 Group can combine their categorized parts. Individual categories can be counted and recorded to be shared with the whole class. This can be charted on the board.

7. Ask students to refer to their copy of the human and rodent skeletal system and compare similarities and differences. Ask students to observe skull pieces. They will probably find two or three different rodent types.
8. Encourage each group to be prepared to report to the whole class their findings.
9. Extension: Assemble a rodent skeleton either each group, whole class, or for interested students.

TYING IT ALL TOGETHER: Encourage exploration and discussion of group members. A chart can be made on the board to show the number of skulls, etc. found in a pellet by each group. Extension could be to assemble a completed rodent skeleton. Care should be taken with elementary students regarding use expectations of sharp pointed equipment. Some students may hesitate to touch the pellet. Explain they are dry, very hard, and feel kind of like a piece of dried mud and grass. Encourage all students to wash hands carefully when completed.

Appendix Unit 2
Chemical Reactions

1. Science 431 Websites 124

2. Videos available from the Confederation Centre Public Library 125

3. Chemical Reactions 126

4. Observing Chemical Reactions 127

5. Scientific Notation and Significant Figures 131

6. Classroom Activities for WHMIS Education 133

7. Three easy chemical reactions
    1. King Kong's Hand 136
    2. Exothermic Exercise 137
    3. Endothermic Cold Wave 138

9. Exercise on Naming Ionic Compounds 139

10. Exercise on Naming Covalent Compounds 140

Science 431 Websites

http://www.discovery.com Click on Puzzlemaker: here you can custom build a variety of puzzle types to match your curriculum.

http://www.freeworksheets.com As the name implies, it has a searchable database of free worksheets.

http://www.chemfiesta.com A great website that has lots of free chemistry worksheets for teachers.

http://www.speciesatrisk.gc.ca Provides information on Canada's threatened, vulnerable, extinct, and extirpated species.

http://solarcooking.org A website that has plans for building solar cookers as well as recipes. A great June activity...providing you have a hot sunny day. S'mores work great!

http://www.webelements.com/ This site has the Periodic table to study and is interactive.

http://www.kccsoft.com/ This site offers a multimedia, computer-based, WHMIS training software program.

http://stas.edu.pe.ca/ **STAS**, the Prince Edward Island Science and Technology Awareness Site, is a bilingual resource for students and teachers to **learn**, **teach**, and **discover**.

http://www.educationworld.com/awards/2002/r0902-06.shtml Another interactive website on the Periodic Table

http://www.recipnet.indiana.edu/common/common.html Simple, Common, and Interesting Molecules - "Molecules are the smallest collection of atoms of a compound which retains the properties of that material." This site explores the structures of a variety of common molecules. They are divided into various categories including Minerals; Elements; Vitamins; Medicines, Drugs and Stimulants; Environmental; Plants and Stuff; Amino Acids; Poisons; and more. Each molecule includes a brief description and a model.

Available from:
Confederation Centre Public Library
Telephone: 368-4642
Fax: 368-4652

Title:	**Nuclear Energy/Nuclear Waste**
Call#:	VID 363.72 NUC PPR
Physical desc.:	1 videocassette (26 min.) : sd., col. ; ½ in.
Publisher:	Educational Media Company,
Date:	1993
Series:	Earth at risk environmental video series.
Level:	JH
Summary:	This program explains the parts of the atom and how scientists use fusion with uranium atoms to create energy, how a power plant works, how we dispose of nuclear wastes, and the different types of background radiation which humans are exposed to.

Chemical Reactions

Demonstrations can be done of various chemical reactions and students can site evidence that a chemical reaction has occurred.

1. mix manganese dioxide and hydrogen peroxide
2. mix vinegar and baking soda
3. either have students do the lab on chemical reactions that is attached or demonstrate some of these reactions
4. demonstrate Kink Kong's hand and/or demonstrations on the pages attached.

Chemistry

Observing Chemical Reactions

Chemical reactions involve the rearrangement of atoms or ions to create new substances with different properties. The evidence comes from observing the properties of the new substances.

The major clues which indicate a chemical reaction are:

1. **A color change** - this is self-explanatory. A new color appears which indicates that a new substance is present. This substance was not present before the reaction because its color was not observed. An example would be an apple which turns brown when the fleshy part is exposed to the air.

2. **The formation of gas** - this is also self-explanatory. An example would be the gas which come out the exhaust of a car. Sometimes in the lab you will see a gas rise out from a solution. For example, when magnesium metal is dropped into hydrochloric acid you will see hydrogen gas bubbles rise to the top of the acid solution.

3. **The formation of a precipitate** - a precipitate is an insoluble product which forms as a result of chemical change. Usually, you will see a precipitate when two solutions are mixed. You will see a solid form which will fall (precipitate) to the bottom of the test tube. Usually, a color change will accompany the formation of a precipitate.

4. **Energy change** - In an energy change, heat will be given off or absorbed. If energy is given off, you will note an increase in temperature (heat) and/or light. Sometimes heat will be absorbed - the temperature will decrease. A reaction in which energy is given off is called **exothermic**. Burning gasoline in a care engine is exothermic. When energy is absorbed, the reaction is **endothermic**. An instant ice-pack is an example of an endothermic reaction.

   In each of the following activities, follow the instructions and then look for evidence for change. Put a check mark beside the evidence observed. You may only see one piece of evidence. In some instances, you may see more than one. Also, make an observation about the evidence. For instance, comment on the color change, the amount of gas or heat, etc.

   Please clean up after using the station. Rinse out the test tube, etc.; and proceed to the next one.

1. Light the gas burner. Burn a small strip of magnesium metal. **Do not look directly at the burning strip!**

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

2. Add a small amount of DRANO to a test tube filled with water. Carefully shake the tube and then feel the bottom of the tube. **DRANO CAN BURN THE SKIN.** After, rinse the contents of the tube int the drain.

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

3. Observe the reaction involving copper metal and silver nitrate solution. Look at the "before" and "after" tubes.

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

4. Add a small piece of antacid to 50 mL of water in a beaker.

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

5. Test a solution for lead ions by adding a few drops of sodium iodide solution to a few drops of test solution in a test tube.

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

6. Add a small amount of magnesium metal to a test tube containing a few drops of HCl.

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

7. Add a few drops of hydrogen peroxide to a test tube and then add a few grains of magnesium permanganate.

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

8. Litmus paper is used to test the acidity of a solution. Add a drop of the test solution to a strip of blue litmus paper. If the paper turns red, the solution is an acid.

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

9. Mix a few drops of calcium nitrate with a few drops of sodium carbonate in a test tube.

   precipitate formed _____ color change _____
   gas formed _____ energy change _____

   Observations _____

10. Mix a few drops of potassium nitrate with a few drops of sodium chloride in a test tube.

    precipitate formed _____ color change _____
    gas formed _____ energy change _____

    Observations _____

11. Add approximately 20 mL of water to a beaker. Then add a small piece of calcium metal (one turning) to the water.

    precipitate formed _____ color change _____
    gas formed _____ energy change _____

    Observations _____

12. Add approximately 10 mL of acid to a test tube. Then add a small piece of zinc metal to the test tube.

precipitate formed _____ color change _____
gas formed _____ energy change _____

Observations _____

13. To a test tube, add a few drops of cobalt (II) chloride. Then **slowly**, add a few drops of sodium hydroxide.

precipitate formed _____ color change _____
gas formed _____ energy change _____

Observations _____

14. Add a few drops of silver nitrate to a test tube. Then slowly add a few drops of sodium chloride.

precipitate formed _____ color change _____
gas formed _____ energy change _____

Observations _____

15. Mix a few drops of sodium chromate solution with a few drops of barium chloride solution in a test tube.

precipitate formed _____ color change _____
gas formed _____ energy change _____

Observations _____

16. Add a small piece of zinc metal to a test tube containing a few drops of copper (II) sulfate (note the color of solution). Put a stopper on the tube and shake for about one minute. Look closely at the zinc in the test tube and then note the color of the solution.

precipitate formed _____ color change _____
gas formed _____ energy change _____

Observations _____

Before you leave the lab, please wash your hands with soap and water.

Scientific Notation and Significant Digits

SCIENTIFIC NOTATION

In science, we often work with very large or very small numbers. Written in this form, these numbers take up much space and are difficult to use in calculations. To work with such numbers more easily, we write them in a shortened form by expressing decimal places as powers of ten. This method of writing numbers in called **scientific notation**.

In scientific notation, the numeral part of a measurement is expressed as:

$M \times 10^n$,

where $1 \leq M < 10$, and *n* is an integer.

Examples:

2000 $= 2 \times 10^3$
450,000 $= 4.5 \times 10^5$
0.0036 $= 3.6 \times 10^{-3}$

SIGNIFICANT DIGITS

Because the precision of all measuring devices is limited, the number of digits that are valid for any measurement is also limited. The valid digits are called the **significant digits.**

The following rules are used to determine the number of significant digits.

1. Non-zero digits are always significant.
2. All final zeros after the decimal point are significant.
3. Zeros between two other significant digits are always significant.
4. Zeros used solely for spacing the decimal point are not significant.

Examples:

753 has 3 significant digits, Rule 1
78.670 has 5 significant digits, Rule 2
10.005 has 5 significant digits, Rule 3
0.0056 has 2 significant digits, Rule 4

Note: There is no way to tell how many zeros in 186,000 are significant. To avoid confusion, integers which end in zero are written in scientific notation. Therefore, if 186,000 had 5 significant digits, for example, it would be written as 1.8600×10^5. Please note that the number of significant digits will be found in the number that appears before the power of ten.

OPERATIONS INVOLVING SIGNIFICANT DIGITS

When doing any calculations with measurements, first, we make the appropriate calculations using the exact values that are given. Then to properly round off the answer to the correct number of

significant digits, we use the following rules:

Addition:

After adding, round off to the same place value as the least precise measurement.

Example: 24.686 + 2.343 + 3.21 = 30.239
Since 3.21 has the least number of decimal places (two), we correctly give the answer as **30.24**.

Subtraction:

After subtracting, round off to the same place value as the least precise measurement.

Example: 45.567 - 13.2 = 32.367
Since 13.2 has the least number of decimal places (one), we correctly give the answer as **32.4**.

Multiplication:

After multiplying, round off to the number that has the least number of significant digits.

Example: 3.22 x 2.1 = 6.762
Since 2.1 has the least number of significant digits (two), we correctly give the answer as **6.8**.

Division:

After dividing, round off to the number that has the least number of significant digits.

Example: 98.781 / 3.47 = 28.46714697...
Since 3.47 has the least number of significant digits (three), we correctly give the answer as **28.5**.

Powers:

After raising to a power, round off to the number of significant digits in the base.

Example: $(2.5)^6 = 244.140625$
Since 2.5 has 2 significant digits, we give the answer as 240, but since it ends in a zero, to avoid confusion, we correctly give the answer as $\mathbf{2.4 \times 10^2}$.

Square Roots:

After taking a square root, round off to the number of significant digits in the radicand.

Example: $\sqrt{45.56} = 6.749814812$
Since 45.56 has 4 significant digits, we correctly give the answer as **6.750**.

WHMIS Activity I

1. Either hand out individual copies of WHMIS product symbols and Consumer product symbols to each student or utilize appropriate overhead.

2. Divide class into working groups of three or four students. Supply each group with an clean, empty, product container (insure label is intact). Utilize examples of both household containers and laboratory chemical containers.

3. Using poster paper, each group shall represent their interpretation of at least two product labels (household/workplace) using the following criteria:
   a) what product symbol is represented ?
      (Consumer versus WHMIS , class , descriptor)
   b) what properties are associated with this symbol?
   c) what is the purpose of supplying symbols on products?
   d) what precautions must be taken when handling this product?

4. Rotate product containers among groups so that each group has an opportunity to work with at least one household product and one workplace product.

5. Ask each group to present to the larger group, an interpretation of one of the products labels so that all products have been represented.

6. As a larger group have the students brainstorm where they might find safety labels at home and in the workplace.

WHMIS Activity II

(This exercise could be utilized as a homework assignment or in- class assignment.)

Have the students perform an audit in their home or in the school chemical store room to identify at least five products with a consumer restricted product symbol or a WHMIS label. Students should record the following information for each of the five products:

a) product name
b) safety symbol on the product
c) hazard represented by the symbol
d) safety precautions to be taken
e) first aid response measures
f) how the product is/should be stored
g) how and why the product is used
h) are there less hazardous products which would do the same job
i) what are the proper disposal techniques for the product and the container

* Remind students to exercise precaution when handling containers/products with safety symbols and labels.

WHMIS Activity III

1. Working in small groups, using the information gathered in Activity II, have each group create a poster depicting the information they would choose to use to educate others about their specific products.

2. Using their poster, have each group present a short class presentation describing how they could use this poster to educate a younger person on the hazard symbols found in their homes, schools and/or workplaces

3. Suggested Materials

   a) 2-3 clean empty containers of each of the following: household products and workplace products, with label intact
   b) overheads or handouts of "consumer restricted symbols" WHMIS symbols, and "Classes of Controlled Products"
   c) poster paper
   d) makers
   e) glue/tape

4. Review and Reflection

   a) With the class discuss and compare the similarities of the labels found in the home to those found in the workplace (explosive, corrosive, flammable, poisonous, reactive, oxidizers).

   b) As a class have students discuss Activity II reflecting on the relevancy and the application of the learning.

5. Attachments

   overheads:
   a) consumer restricted product symbols
   b) WHMIS symbols and descriptions
   c) classes of controlled products

King Kong's Hand

King Kong's hand must have been very big to hold a lady in it. Now, you can make your own big hand with just a few simple materials. Without the marker lines, the hand becomes a cow's udder, the bag under the cow that holds the milk–an udderly fantastic trick! Anyway you look at it, it's pure chemistry, and it will teach you about an important gas that all chemists know.

You will need:

1. disposable latex glove
2. 1/4 cup of baking soda
3. ½ cup of vinegar
4. brown or black permanent marker pen (optional)

What to do: A friend or assistant would be helpful for this experiment, and it is best done over a sink or basin (or outside) as it can be messy!

For a King Kong hand, make short vertical lines with a marker pen on each side of the glove to represent King Kong's hairy hand. If you are making a cow's udder, leave the glove plain.

Have your helper hold the glove over the sink or basin while you pour the baking soda, followed by the vinegar, into the glove. Now, very quickly, close the opening of the glove with your hand to make an airtight seal. Hold it tightly for several minutes.

What Happens: The glove blows up like a balloon, then after several minutes goes back to its normal size.

Why: When you mixed the baking and vinegar together, you make a very popular gas called carbon dioxide (CO_2). This is why the solution started to fizz and foam up and spill out over the top of the glove before you closed it up. Once the gas is trapped in the glove, it has no place to go, so it blows the glove up. Eventually, the reaction grows less, the gas succeeds in escaping, and the glove returns to its normal size.

What a Gas

Baking soda (sodium bicarbonate) is a compound made up of the elements hydrogen, sodium, oxygen, and carbon. When vinegar is added (water and acetic acid), a chemical reaction takes place; the elements carbon and oxygen linked together to make a new gaseous compound called carbon dioxide.

Exothermic Exercise

What kind of chemical change takes place when yeast mixes with hydrogen peroxide? This extremely exciting experiment is bound to warm you up.

You will need:

- thermometer
- small bowl
- 1 tablespoon of quick-rising dry yeast
- 1/4 cup of hydrogen peroxide
- spoon
- pencil and paper

What to do: Record the temperature showing to the thermometer, and then place it in the bowl. Pour in the hydrogen peroxide, add the yeast, and stir the solution. As you watch what happens, feel the lower side and bottom of the bowl. Wait a minute or two; then spoon out the thermometer and record the temperature again.

What Happens: the solution foams up and bubbles, and the bottom and sides of the bowl feel very warm. Steam can be seen coming from the solution. The higher thermometer reading shows that heat has been produced.

Why: When yeast and hydrogen peroxide mix chemically, the hydrogen peroxide changes into oxygen and water molecules. The bubbles are produced by the oxygen gas escaping during the chemical change. This change also produces heat. When heat is produced in a chemical change, we call the process exothermic.

Endothermic Cold Wave

If a chemical change can cause heat (exothermic), can another chemical change make something cold?

Caution: Epsom salts can be a harmful solution. Dispose of it carefully after use.

You will need:
- thermometer
- one tablespoon of Epsom salts
- tap water, neither hot nor cold
- spoon
- medium-size jar
- pencil and paper

What to do: Fill the jar with tap water. Place the thermometer in the water. With you hand, feel the coolness of the jar while you wait until the thermometer registers the water's temperature. Write the temperature down. Now stir in the Epsom salts. Feel the jar again. Is there a change? After a couple of minutes, take out the thermometer and record the temperature again.

What Happens: The jar feels slightly colder, and the temperature of the water after the chemical change is actually lower.

Why: In the previous experiment "Exothermic Exercise", a chemical change produced heat energy. But sometimes heat is instead used up in the chemical change. When Epsom salts, or magnesium sulfate, is added to the water, it uses the water's natural heat energy to split apart ions of sulfate and magnesium. Ions are positive or negative electrically charged atoms that occur when electrons are lost or gained.

The chemical change in this experiment is called endothermic because more heat energy is being used up than is being produced. This is why the water gets colder, and why Epsom salts are used to soak a sprained ankle and draw the heat out of an injury.

Naming Ionic Compounds

Give the name and the molar mass of each of the following ionic compounds

	NAME	MOLAR MASS
1.	Na_2S	
2.	NaBr	
3.	$MgBr_2$	
4.	KCl	
5.	$FeCl_2$	
6.	$FeCl_3$	
7.	$ZnCl_2$	
8.	BeO	
9.	CrF_2	
10.	Al_2S_3	
11.	PbO	
12.	Li_3N	
13.	TiI_4	
14.	CO_3N_2	
15.	Mg_3P_2	
16.	GaF_3	
17.	Ag_2S	
18.	CuO	
19.	Al_2S_3	
20.	Be_3P_2	

Naming Covalent Compounds

Write the formulas for the following covalent compounds:

1. antimony tribromide _____
2. hexaboron silicide _____
3. chlorine dioxide _____
4. hydrogen iodide _____
5. iodine pentafluoride _____
6. sodium chloride _____
7. ammonia _____
8. phosphorus triiodide _____

Write the names for the following covalent compounds:

9. P_4S_4 _____
10. O_2 _____
11. SeF_3 _____
12. Si_2Br_2 _____
13. SCl_4 _____
14. CH_4 _____
15. B_2Si _____
16. NF_3 _____
17. S_4Cl_3 _____
18. F_3H_4 _____
19. N_4H_4 _____
20. C_6H_6 _____

Appendix Unit 4
Weather Systems

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Science 431 Websites

http://www.discovery.com Click on Puzzlemaker: here you can custom build a variety of puzzle types to match your curriculum.

http://www.freeworksheets.com As the name implies, it has a searchable database of free worksheets.

http://www.chemfiesta.com A great website that has lots of free chemistry worksheets for teachers.

http://www.speciesatrisk.gc.ca Provides information on Canada's threatened, vulnerable, extinct, and extirpated species.

http://solarcooking.org A website that has plans for building solar cookers as well as recipes. A great June activity...providing you have a hot sunny day. S'mores work great!

www.thefutureschannel.com This Futures Channel Website has several links which offer short videos on several themes, like the one below.

http://www.thefutureschannel.com/science/index.html This link offers a video on tracking tornadoes.

http://weatheroffice.ec.gc.ca/faq_e.html#weather2 Environment Canada website with lots of information on weather topics. Answers many questions on all aspects of weather.

http://www.ucar.edu/educ_outreach/webweather/ Learn what makes weather wet and wild, do cool activities, and become hot at forecasting the weather on Web Weather for Kids! Links to Games, Stories, Activities, Weather Ingredients, Clouds, Hurricanes, Thunderstorms, Tornadoes, Blizzards, and Winter Weather. An excellent site with lots of information, but children depicted are younger.

http://www.ucar.edu/educ_outreach/webweather/ Learn what makes weather wet and wild, do cool activities, and become hot at forecasting the weather on Web Weather for Kids!

http://www.ucar.edu/learn/1.htm A website that offers a large amount of information for teachers and such as: Introduction to Atmosphere, Introduction to Ozone, Introduction to Climate Stratospheric Ozone, The "Greenhouse Effect", Tropospheric Ozone, and Global Climate Change

http://www.k12science.org/k12partner02/k-8weather.html This website gives information on forecasting the weather, instruments that are used to gather weather data, and how such weather information is displayed on weather maps.

http://www.unidata.ucar.edu/staff/blynds/Skymath.html This site gives 16 classroom activities of SkyMath. Lots of links.

Recommended Videos

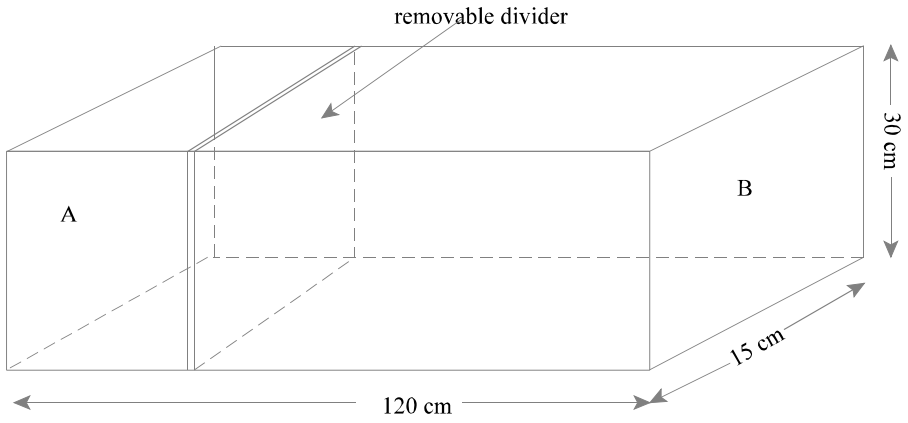
1. Nova Frontline series videos (vid 363.738 WHA PPR)

Weather Fronts

Use the procedure shown below to demonstrate the behaviour of fronts. This activity can also be used to emphasize the concept of density. Students may do this activity in groups or a demonstration may be done by the teacher.

Procedure and Observations:

Use a wave tank similar to the one described below.



Remove the divider (bristol board) from end A. Place approximately 6-10cm of cold tap water in the tank. Dissolve table salt in this cold water to increase the density. Cover the surface of the water with a layer of paper towelling. Slowly and gently add approximately 6-10 cm of hot tap water to the tank. Gently remove the paper towelling by slowly sliding it up one side of the tank.

Place the bristol board in end A of the tank. Add food coloring to the enclosed water at end A and mix this water well.

Remove the glass divider and observe the motion(s) of the colored water. Record and interpret the results.

Students answer the following questions and pass in their answers.

1. Why was salt added to the water?
2. Compare the densities of the three bodies of water:
   a) lower layer
   b) upper layer
   c) layer behind the partition
3. Why did the colored water move between the other two layers?
4. What did you observe as the “wall” was lifted?
5. How does this activity demonstrate unsettled weather when air masses meet?

Seawater Lab: Water Masses of Different Densities

Purpose:
a) To illustrate that water masses of different densities retain their identity.
b) To observe convective sinking.

Materials and Procedures:
Listed below are two solutions that will be placed in a beaker to simulate one body of water overlying a second body of water in various situations. (Example: warm, fresh water flowing into a saltwater bay).

Half fill a beaker with the bottom layer of sample. Cover the surface of the water carefully with a round piece of paper and slowly and gently add the top mix (the best way to do this is to use a long instrument that allows the top solution to slide down to the paper). Carefully remove the paper. The success of this experiment depends on being able to form a sharp interface between the two layers. Make observations of what takes place (record this with the data). Your observations should take place over a minimum of 15 minutes. Interpret your results (data) in the analysis section of your report. Repeat the above procedure for each of the other four samples. Compare the results in your analysis and account for the differences.

Sample 1:
top layer - hot, fresh water (add food coloring)
bottom layer - cold, salt water (as much salt as will dissolve)

Sample 2
top layer - cold, fresh water (add food coloring)
bottom layer - hot, salt water

Sample 3:
top layer - cold, salt water (add food coloring)
bottom layer - hot, fresh water

Sample 4:
top layer - hot, salt water (add food coloring)
bottom layer - cold, fresh water

Sample 5:
top layer - hot, fresh water (add food coloring)
bottom layer - cold, salt water (as much salt as will dissolve)

Lab Water Masses of Different Densities

Answer the following questions on a sheet of looseleaf and pass it in at the beginning of class tomorrow.

1. What is meant by “density”?

2. Which is more dense - cold water or hot water; salt water or fresh water?

3. Describe what happened in sample number 1 and why it happened?

4. Describe what happened in sample number 2 and why it happened?

5. Describe what happened in sample number 3 and why it happened?

6. Describe what happened in sample number 4 and why it happened?

7. Describe what happened in sample number 5 and why it happened?

8. In this lab, what seemed to be the biggest factor in the density differences - the amount of salt or the temperature?

9. Which sample was most like the convection of air (warm air expands and rises and cool air sinks).

Building Weather Instruments

Materials for the construction of weather instruments

- small cups (like those used for ketchup at fast food restaurants)
- straws
- popsicle sticks or wooden splints
- pins/tacks
- corks
- glue
- elastics
- ring stand (as a base)
- cardboard
- tape
- test tubes
- scissors
- jars/cans
- rulers
- thermometers
- string
- rubber gloves (rubber for barometer)
- cotton to keep the thermometer wet for the wet thermometer of a psychrometer

Weather Unit Water Cycle - Thermodynamics (heat transfer)

CLOUD IN A BOTTLE

Safety

Describe the dangers and safety measures taken to avert injury.

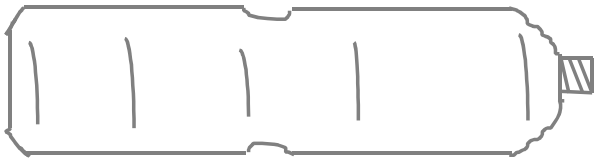
In this lab a clear plastic water bottle with a few drops of water inside, will be capped then be twisted as demonstrated by the instructor.

Because the water bottle is clear, we can see inside and observe the few water droplets on the side and bottom of the bottle. These drops are the only observed water in the bottle. The air/atmosphere inside the bottle is clear.

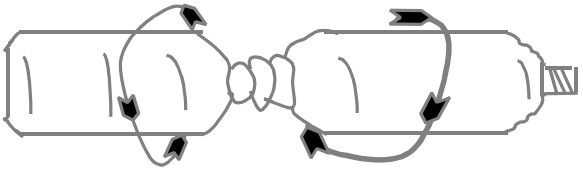
DANGER - follow safety procedures - Use extreme caution.

Twist the bottle and while the bottle remains twisted, quickly unscrew the cap as demonstrated.

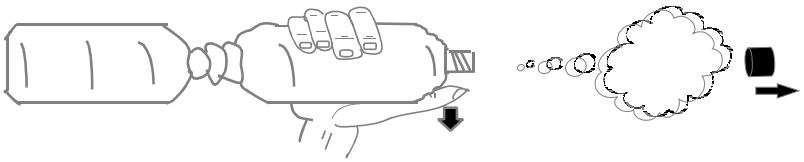
If executed correctly the bottle top will be propelled with a jet like blast across the room.



Step 1 - Take off the label then empty any excess liquid, tighten lid on bottle.

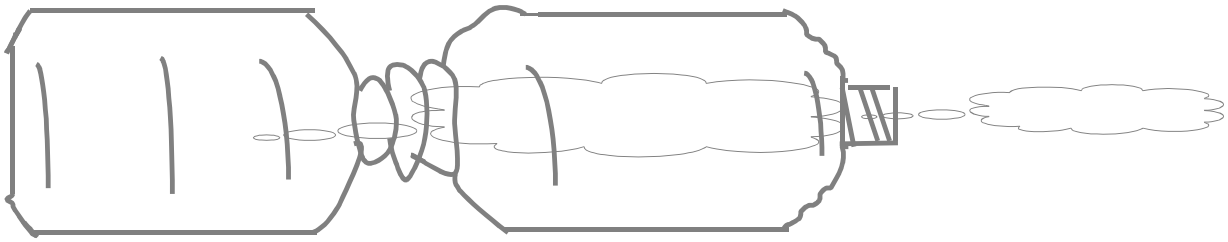


Step 2 - Twist bottle back and forth to warm up plastic, finally keep twisting bottle in opposite directions with both hands



Step 3 -

Hold the bottle with left hand and use right hand thumb to gently twist of cap. If done correctly because of the pressure in the bottle that is created the cap will explode from the bottle and fly across the room.



Step 4 - After the lid flies across the room, check the bottle. To most they think " oh cool, look at the smoke". I assure you it is not smoke. For it is the combination of moisture, heat energy, and pressure that gives you not smoke but a cloud in a bottle.

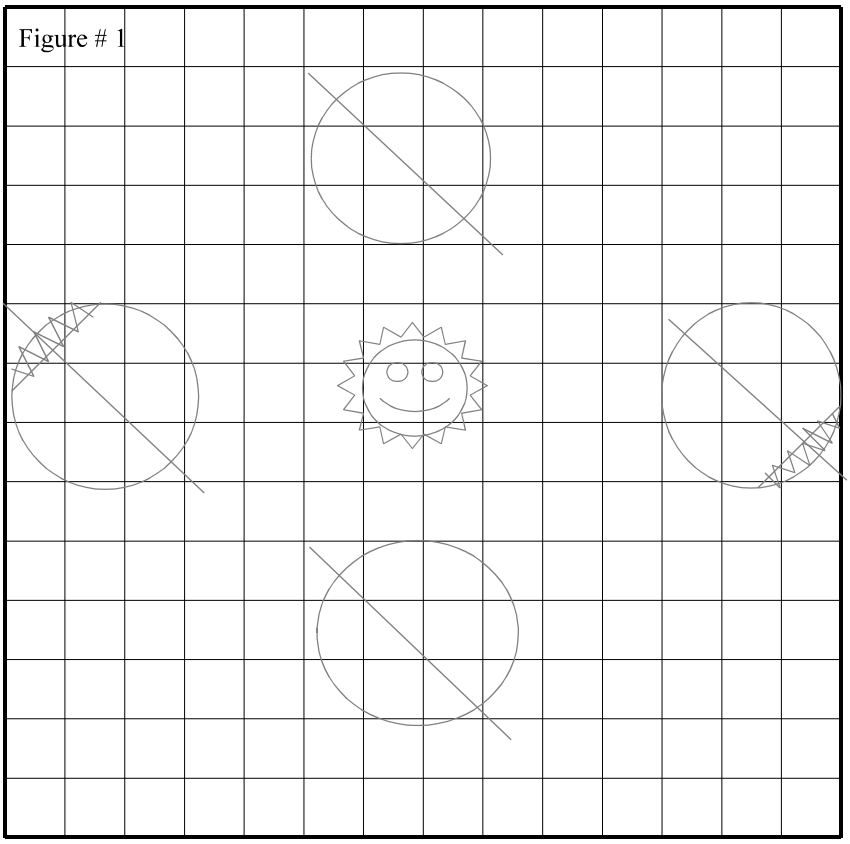
How Earth's Angle of Inclination and Curved Surface Influence the Global Heating Balance

Angle of Inclination and Global Heating Balance

Figure # 1 illustrates the earth's orbit around the sun, note that earth's path is not circular, but is in fact elliptical (oval) in shape. As a result of this elliptical orbit, the earth's distance from the sun is not constant. In fact, earth is closer to the sun (perihelion) during the Northern Hemisphere's winter and furthest from the sun (aphelion) during the Northern Hemisphere's summer. What then can explain why our Northern Hemisphere experiences winter when earth is closer to the sun then during our summer?

The answer to the above question lies in the fact that the earth's axis of rotation is not perpendicular to the plane of the ecliptic but is inclined at an angle of 23.5 degrees to the ecliptic. Figure #1 illustrates these two facts.

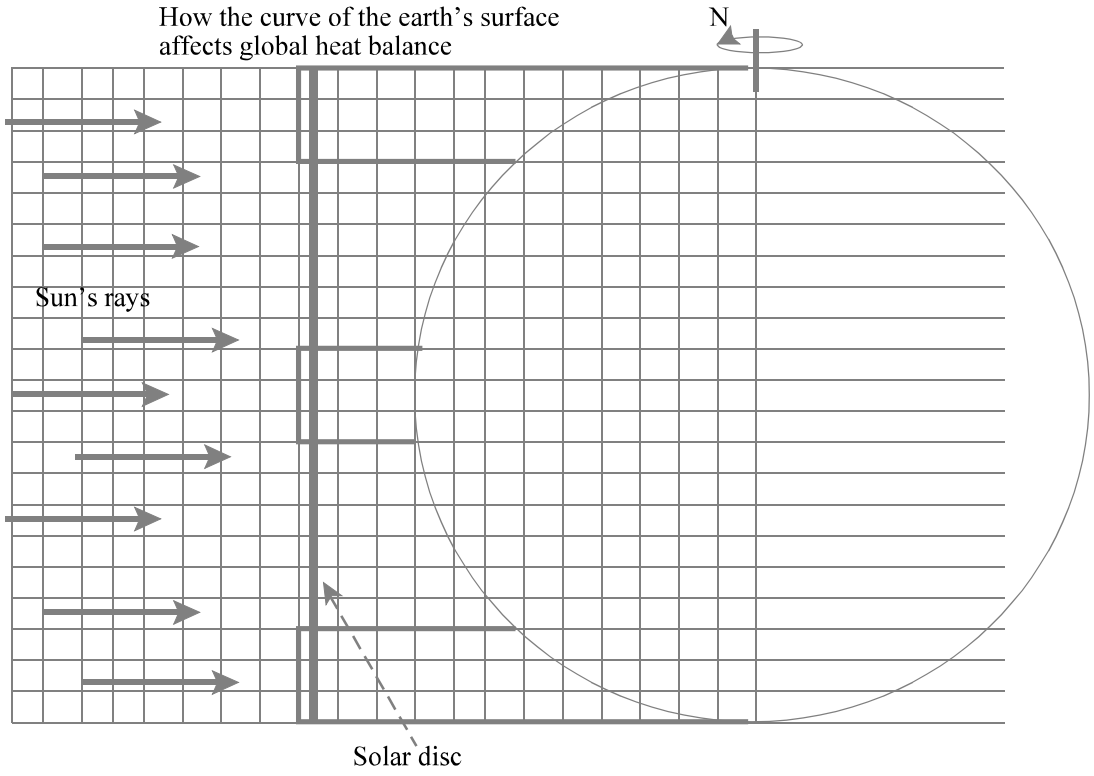
Because the earth's rotation is inclined at 23.5 degrees, the earth's surface experiences a difference in heating (differential heating) between the two hemispheres. Figure #1 illustrates this difference in the amount of heat received in the northern and southern hemispheres on June 21st and December 21st (give or take a day or two).



However, during the spring and autumn seasons, the earth's axis of rotation is neither inclined towards or away from the sun as a result both hemispheres receive equal amounts of solar heat....the spring and autumnal equinoxes respectively.

Earth's Curved Surface Affect On Global Heating Balance

A sphere like earth when seen face-on in space appears as a DISC or FLAT CIRCLE, like a full moon. This solar disc (seen in Figure #2) represents the surface area receiving solar energy equally distributed over its surface. However, the earth's surface is curved and this curvature causes the energy received to be spread out over a greater and greater area as the earth's curvature bends further and further away from where the solar disc touches the earth's surface (see Figure # 2). The greater the curvature, the greater the surface area a fixed amount of solar energy is spread over. This explains why during the summer in the Northern Hemisphere even though land north of the Arctic Circle receives 24 hours of sunlight, the summer temperatures are cool.



The three sections receive the same amount of solar heating at solar disc - 3 squares each. The middle section's solar disc heat spread essentially over the same area on earth's surface as the disc area. However the solar disc heat at the other two sections is seen spread over a greater area on earth's surface, because of the curvature of the earth's surface. Therefore, heat energy received per unit area diminishes as distance from direct overhead sun's rays increases.

Science 431 - Weather Stations Lab

Patricia Shields - Charlottetown Rural

Station # 1 - Smog

1. What is smog? What is it made from?
2. When do smog problems become particularly bad in Canada? Explain why this happens.
3. What are the health effects experienced from smog?

Station # 2 - UV and You

1. What do UV rays cause?
2. What are the three types of UV rays?
3. List six factors that UV rays depend on.
4. List four ways you can protect yourself against UV.

Station # 3 - Drought and Probability of Precipitation

1. What is drought?
2. Where does drought frequently occur in Canada?
3. What effect does drought have in agricultural area? In forests? To wildlife?
4. What is the probability of precipitation (P.O.P.)?
5. What does 20% P.O.P. imply? 40%? 70%?
6. Give an example of the usefulness of a P.O.P. forecast.

Station # 4 - Global Climate Change

1. What are greenhouse gases?
2. List three greenhouse gases.
3. List the effects of climate change on PEI (from the map).
4. List three actions you can take to make a difference in reducing global warming.

Station # 5 - Blizzards and Windchill

1. Where are blizzards most common in Canada? Where are they rare?
2. List three precautions you can take when a blizzard warning has been issued?
3. Describe what hypothermia is and what the symptoms of hypothermia are?
4. Give two reasons why the wind make you feel “icier”?
5. What are the windchill effects at -25˚C? -60˚C?
6. What is the windchill equivalent temperature when it is -10˚C outside with 30km/h winds?

Science - Weather Stations Lab continued

Station # 6 - Tornados and Thunder, Lightning, and Hail Storms

1. How many thunderstorms happen everyday worldwide?
2. What is thunder?
3. How can you judge how close lightning is?
4. What do satellites show?
5. What do you do when you are caught outdoors in a thunderstorm?
6. Describe three things that you should do when a tornado threatens to strike your area?
7. List three examples of where to find the best shelter during a tornado?

Station # 7 - Weather Watches, Warnings and Advisories and Humidity

1. What is a weather warning?
2. What is a cold wave advisory?
3. Explain what a frost warning is.
4. What is relative humidity?
5. What is the degree of comfort when the humidex is at 30˚C to 39˚C? Above 45˚C?
6. What happens to your hair length as the humidity increases?

Station # 8 - The Climate

1. Explain the difference between climate and weather?
2. List four different things that our climate effects.
3. List four Canadian inventions mentioned in this pamphlet that have been discovered as a result of our climate.

Station # 9 - Canada's Weather Service Since 1871

1. What is George Kingston famous for?
2. Under "Tools of the Trade", what do each of the following measure? Barometer? Anemometer? Thermometer?
3. Explain what the Black Summer of 1816 was.
4. What do climatologists believed caused the Black Summer of 1816?

Station # 10 - Weather, Climate, and Health

1. Under heatwaves, describe what heat stroke causes and what heat exhaustion causes. What is the main difference between the two of them?
2. Under Disaster Mitigation, list the number of deaths causes each year by drought and floods. High wind and storms? Earthquakes?

Weather

PEI Government Website Assignment **Name:_____**

I. Log on to the PEI website www.gov.pe.ca

II. Click on the weather section and check the current conditions for:

Conditions	Charlottetown (Environment Canada)	Charlottetown (The Weather Network)
Temperature:		
Barometer:		
Wind:		
Dew Point:		
Relative Humidity:		
Sunrise/Sunset:		
Observed:		

III. Go to the *Four Day Forecast (Intellicast*) site.

1. How many days does this site predict weather for? _____

	High (˚C)	Low (˚C)
Wednesday		
Thursday		
Friday		
Saturday		

IV. Go to the **Forest Fire Weather Index**.

1. For all areas of PEI today the forest fire index is _____.
2. The number to cal if you see a fire is _____.
   On Prince Edward Island, you require a valid burning permit for any open fire within _____ metres of burnable vegetation during the _____ _____.

   Consult you burning permit to check on the fire weather index and wind speed conditions it states. It is an offense to burn without a valid permit or to fail to advise your local fire department before you start the fire. Fines for burning without a valid permit are between _____ and you are assessed the cost of extinguishing the fire. In addition, those who cause escape fires are liable in court for damage caused to neighbouring properties.

V. Go to the **Canadian Tire and Current Conditions** and check the tides for today in your area.

Low _____, High _____
Low _____, High_____

VI. Go to the **Frogwatch** section and click on *Why Monitor Frogs*.

Give five points in this section which explain why frogs are important environmental indicators.
_____
_____
_____
_____

VII. Go to the **Visitors Guide** and click on *Getting There*.

Driving Distances and Directions
Prince Edward Island is roughly _____km from Toronto,
_____ km from Montreal, _____ km from Boston, and
_____ km from New York City.

A little farther along check out the bridge facts and list three of the interesting facts.
_____
_____
_____
_____
_____
_____

VIII. Go back to the **Visitors Guide** to the section call **things to do** and select *beaches*. Complete the following: Help Us Protect our Dunes and Seaside Wildlife.

_____ are sensitive ecosystem and havens for wildlife.
You help us to conserve _____, _____, and _____ when you:
Keep _____ on roads, and _____ on designated pathways.
_____
Respect signs and zones for protection of wildlife such as the endangered _____ _____. Avoid visiting bird colonies, nests, and roosts.
Now, go back to **Things to Do** and select *golf*. The number of 18 hole golf courses on PEI is _____ and there are _____ 9 whole courses.

On the sidebar go to the **Jobs** Section:

1. Where is the Access PEI Charlottetown site located?
   _____
2. Choose one of the Current Opportunities. Which department is it with?
   _____
   What is the salary?_____
   Give a brief description of the job. _____
   _____
   _____
   _____

   Check out the **government section**. Can you find who you would need to contact for:
   Land subdivision inquiries and septic tank permit _____
   Silviculture _____
   Tourism PEI Trade and Sales Team _____
   Water testing _____

Earth Facts

Average Distance from Sun
About 150,000,000 kilometres (90,000,000 miles)

Diameter Through Equator
12,756.32 kilometres (7653.8 miles)

Circumference Around Equator
40,075.16 kilometres (24,045.1 miles)

Surface Area
Land area: about l48,300,000 sq. kilometres,
or about 30% of total surface area
Water area: about 361,800,000 sq. kilometres,
or about 70% of total surface area

Rotation Period
23 hours, 56 minutes, 4.09 seconds

Revolution Period Around Sun
365 days, 6 hours, 9 minutes, 9.54 seconds

Temperature
Highest: 58^{o}C at Al Aziziyah, Libya
Lowest: –90^{o}C at Vostok, Antarctica
Average surface temperature 14^{o}C

Highest and Lowest Land Features
Highest: Mount Everest, 8848 metres above sea level
Lowest: shore of Dead Sea, 396 metres below sea level

Ocean Depths
Deepest: Mariana Trench in Pacific Ocean; 11,033 metres below surface
Average ocean depth, 3795 metres