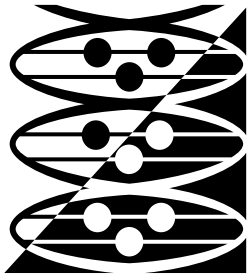

SCIENCE AND TECHNOLOGY 11

Integrated Resource Package 2008

BRITISH COLUMBIA
The Best Place on Earth

IRP 170

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This document is a revision of the Science and Technology 11 IRP (1995). This document introduces Suggested Achievement Indicators, clear and succinct Prescribed Learning Outcomes, a snapshot of the course's Key Elements, and other minor refinements, while maintaining the original intent and essence of the 1995 curricular content.

Many people contributed their expertise to the Science and Technology 11 IRP(2008). The Project Managers (2006-2008) were Mr. Waël Afifi and Mr. Richard DeMerchant of the Ministry of Education, working with other ministry personnel and our partners in education. We would like to thank all who participated in this process, including the teams of educators who developed the 1995 Science and Technology 11 IRP, and the following individuals who contributed to the 2006-2008 updating of this document:

Thomas Hastie	School District No. 36 (Surrey)
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Gesa von Keyserlingk	School District No. 39 (Vancouver)
Hold Fast Consultants Inc.	Project co-ordination, writing, and editing

This Integrated Resource Package (IRP) provides basic information teachers will require in order to implement Science and Technology 11. Once fully implemented, this document supersedes the *Science and Technology 11 Integrated Resource Package (*1995).

The information contained in this document is also available on the Internet at www.bced.gov.bc.ca/irp/irp.htm

The following paragraphs provide brief descriptions of the components of the IRP.

INTRODUCTION

The Introduction provides general information about Science and Technology 11, including special features and requirements.

Included in this section are:

- a rationale for teaching Science and Technology 11 in BC schools
- information about graduation program requirements and provincial examinations
- goals for Science and Technology 11
- information about the revision process that led to the publication of this document
- descriptions of the curriculum organizers – groupings for Prescribed Learning Outcomes that share a common focus
- Aboriginal content in the science curriculum
- suggested time frame for each course
- a graphic overview of the curriculum

CONSIDERATIONS FOR PROGRAM DELIVERY

This section of the IRP contains additional information to help educators develop their school practices and plan their program delivery to meet the needs of all learners.

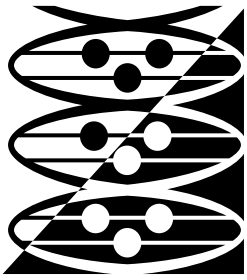
PRESCRIBED LEARNING OUTCOMES

This section contains the Prescribed Learning Outcomes, the legally required content standards for the provincial education system. The Prescribed Learning Outcomes define the required knowledge, skills, and attitudes for each course. They are statements of what students are expected to know and be able to do by the end of the course.

STUDENT ACHIEVEMENT

This section of the IRP contains information about classroom assessment and measuring student achievement, including sets of specific Suggested Achievement Indicators for each Prescribed Learning Outcome. Suggested Achievement Indicators are statements that describe what students are able to do in order to demonstrate that they fully meet the expectations set out by the Prescribed Learning Outcomes. Suggested Achievement Indicators are not mandatory; they are provided to assist in the assessment of how well students achieve the Prescribed Learning Outcomes.

Also included in this section are Key Elements – descriptions of content that help determine the intended depth and breadth of the Prescribed Learning Outcomes.



INTRODUCTION

Science and Technology 11

This Integrated Resource Package (IRP) sets out the provincially prescribed curriculum for Science and Technology 11. The development of the IRP has been guided by the principles of learning:

- Learning requires the active participation of the student.
- People learn in a variety of ways and at different rates.
- Learning is both an individual and a group process.

In addition to these three principles, this document recognizes that British Columbia's schools include students of varied backgrounds, interests, abilities, and needs. Wherever appropriate for this curriculum, ways to meet these needs and to ensure equity and access for all learners have been integrated as much as possible into the Prescribed Learning Outcomes and Suggested Achievement Indicators.

This document represents a revision of the 1995 IRP. This updating has been undertaken for the purpose of:

- clarifying the Prescribed Learning Outcomes
- introducing Suggested Achievement Indicators
- addressing content overload
- reconciling this course with other science courses
- making the content current
- organizing the content in a more workable way

Resources previously recommended for the 1995 version of the curriculum, where still valid, continue to support this updated IRP.

RATIONALE

Science education in British Columbia is designed to provide opportunities for students to develop scientific knowledge, skills, and attitudes that will be relevant in their everyday lives and their future careers. In addition to introducing students to current concepts, findings, and processes in various scientific disciplines – biology, physics, chemistry, astronomy, and geology – it encourages them to:

- develop a positive attitude toward science
- examine basic concepts, principles, laws, and theories through scientific inquiry
- demonstrate respect for precision
- develop awareness of assumptions in all forms of science-related communication
- separate fundamental concepts from the less important or irrelevant
- develop the capacity to think critically, in order to identify supporting or refuting information and bias
- recognize that scientific knowledge is continually developing
- use given criteria for evaluating evidence and sources of information
- actively gain knowledge, skills, and attitudes that provide the basis for sound and ethical problem solving and decision making
- assess the impact of science and technology on individuals, society, and the environment
- cultivate appreciation of the scientific endeavour and their potential to contribute to science

To prepare students for further education and for their adult lives, the Science and Technology 11 curriculum engages students in the investigation of scientific questions and the development of plausible solutions. Science education develops and builds on students' sense of wonder about the world around them and encourages a feeling of responsibility to sustain it. Science education fosters students' desire to meet a challenge, take risks, and learn from mistakes. It prompts a curiosity about the changing world and helps students understand that the skills and knowledge they are gaining will be refined and expanded to reflect advances in scientific knowledge and technology.

REQUIREMENTS AND GRADUATION CREDITS

Science and Technology 11 is one of the courses available for students to satisfy the Grade 11-12 Graduation Program science requirement. Science and Technology 11 is designated as a four-credit course, and must be reported as such to the Ministry of Education for transcript purposes. Letter grades and percentages must be reported for this course. It is not possible to obtain partial credit for this course.

The course code for Science and Technology 11 is SCT 11. This course is also available in French (Science et technologie 11; course code SCTF 11).

GRADUATION PROGRAM EXAMINATION

Science and Technology 11 is one of the courses that do not have a Graduation Program Examination. Students should be advised that some post-secondary institutions require Grade 12 exams to meet entrance requirements, and that writing Grade 12 exams also provides opportunities for provincial scholarships. Any student wishing to take this course as a graduation requirement should be aware that without another Science course, at the graduation level which does have the optional Graduation Program examination, their post graduation options may be limited.

For more information, refer to the Ministry of Education examinations web site:
http://www.bced.gov.bc.ca/exams/

GOALS FOR SCIENCE AND TECHNOLOGY 11

The overriding goals for Science and Technology 11 are represented across the Prescribed Learning Outcomes for Science and Technology 11. These goals are in alignment with the foundational statements from the Pan-Canadian Science Framework (Council of Ministers of Education, Canada, 1997) that delineate the following four critical aspects of students' scientific literacy.

- **GOAL 1: Science, technology, society, and the environment (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.

- **GOAL 2: 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.

- **GOAL 3: Knowledge** – Students will construct knowledge and understandings of concepts in life science, physical science, and Earth and space science, and apply these understandings to interpret, integrate, and extend their knowledge.

- **GOAL 4: 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.

THE 2008 SCIENCE AND TECHNOLOGY 11 REVISION

This 2008 revision incorporates components from the 1995 provincial Science and Technology 11 curriculum and contributions of groups of British Columbia educators. At the same time, the allocation of topics at each grade reflects a commitment by the Ministry of Education to align, where possible and appropriate, the scope and sequence of science education in British Columbia with the scope and sequence outlined in the *K to 12 Common Framework of Learning Outcomes* (developed and published by the Council of Ministers of Education, Canada, under the aegis of the *Pan-Canadian Protocol for Collaboration on School Curriculum*). Among other benefits, it is anticipated that this alignment will facilitate interprovincial transfers for students leaving or arriving in British Columbia and give British Columbia educators access to a wider range of choice when acquiring textbooks and other learning resources to teach Science and Technology 11. A variety of resources were used in the development of this IRP:

- British Columbia *Science and Technology 11 IRP* (1995)
- *Pan-Canadian Common Framework of Science Learning Outcomes* (1997), Council of Ministers of Education, Canada (http://cmec.ca/science/framework/)
- Science Curriculum Review Report (2001) http://www.bced.gov.bc.ca/branches/pser/whatsnew.htm#scrr
- Provincial science curricula
  - APEF (Atlantic Provinces Education Foundation)
  - Ontario
  - Manitoba
  - Alberta
- *Secondary Science Revisions*, *Program Introduction* (2003), Alberta Learning, Alberta, Canada
- *Atlas of Science Literacy* (2001), American Association for the Advancement of Science,

Project 2061, National Science Teachers Association, Washington DC
- *Designs for Science Literacy* (2000), American Association for the Advancement of Science, Project 2061, National Science Teachers Association, Washington DC
- *Shared Learnings* (1998), Aboriginal Education Initiative, British Columbia Ministry of Education
- *Science and Technology Education: Foundations for the Future* (1993), Australian Ministry of Education, Australian Government Publications ISBN 0 644
- *Technology in the New Zealand Curriculum* (1995), New Zealand Ministry of Education, New Zealand Government Publications ISBN 0 478 02898 9
- *Supplement to The New Zealand Curriculum: Draft for Consultation 2006* (2006), New Zealand Ministry of Education, New Zealand Government Publications, Item Number 31653
- *Curriculum, Learning and Effective Pedagogy: A Literature Review in Science Education* (2002), A Report to the Ministry of Education, New Zealand ISBN 0-478-27264-2

CURRICULUM ORGANIZERS

A curriculum organizer consists of a set of Prescribed Learning Outcomes that share a common focus. The Prescribed Learning Outcomes for Science and Technology 11 are grouped under the curriculum organizers or modules indicated below.

Note that the ordering of organizers and Prescribed Learning Outcomes in the Science and Technology 11 curriculum are not intended to imply an order of instruction. Some of the Prescribed Learning Outcomes in the core topics should be integrated throughout all of the modules to enable students to gain a better understanding of their application, value and meaning.

It should be noted that students do not need to pursue the learning in all modules but that teachers may select topics from the modules based on the instructions in the following table.

Science Module	Technology Module
Choose a minimum of two organizers from the Science Module	Choose a minimum of two organizers from Technology Module
• Agriculture • Applied Chemistry • Forensics • Health • Natural Resources and the Environment	• Computers and Communication • Home and Technology • Personal Technologies • Space Exploration • Transportation

ABORIGINAL CONTENT IN THE SCIENCE CURRICULUM

Integration of authentic Aboriginal content into the K to 12 science curriculum with the support of Aboriginal people will help promote understanding of BC's Aboriginal peoples among *all* students.

The incorporating of Aboriginal science with western science can provide a meaningful context for Aboriginal students and enhance the learning experience for all students. The inclusion of Aboriginal examples of science and technologies can make the subject more authentic, exciting, relevant and interesting for *all* students.

Traditional Ecological Knowledge and Wisdom (TEKW) is defined as the study of systems of knowledge developed by a given culture. It brings the concept of wisdom to the discussion of science and technology. TEKW tends to be holistic, viewing the world as an interconnected whole where humans are not regarded as more important than nature. It is a subset of traditional science, and is considered a branch of biological and ecological science. This knowledge, with its characteristic respect for sustaining community

and environment, offers proven conceptual approaches that are becoming increasingly important to all BC residents.

Examples of TEKW science may be accessed through living elders and specialists of various kinds or found in the literature of TEKW, anthropology, ethnology, ecology, biology, botany, ethnobiology, medicine, horticulture, agriculture, astronomy, geology, climatology, architecture, navigation, nautical science, engineering, and mathematics.

Recognition of the importance of incorporating TEKW into environmental planning is evident in science-based reports and agreements in Canada and internationally. The Brundtland Commission report, *Our Common Future* (World Commission on Environment and Development, 1987), draws attention to the contributions of traditional knowledge. In British Columbia, the report of the scientific panel for sustainable forest practices in Clayoquot Sound emphasizes TEKW and the importance of including indigenous knowledge in planning and managing traditional territories. The recognition of TEKW globally is explicitly addressed in international agreements including the Convention on Biological Diversity, Agenda 21, and UNCED '92, or the Earth Summit at Rio de Janeiro.

LEARNING RESOURCES

For the current list of recommended learning resources, please check the Learning Resource Website:
www.bced.gov.bc.ca/irp_resources/lr/resource/gradcoll.htm

The Grade Collection chart lists the recommended learning resources by media format, showing links to the curriculum organizers and sub-organizers. The chart is followed by an annotated bibliography. Teachers should check with suppliers for complete and up-to-date ordering information.

Ministry policy concerning Learning Resources can be found on the Ministry's policy website:
www.bced.gov.bc.ca/policy/policies/

SUGGESTED TIMEFRAME

Provincial curricula are developed in accordance with the amount of instructional time recommended by the Ministry of Education for each subject area. Teachers may choose to combine various curricula to enable students to integrate ideas and make meaningful connections.

Science and Technology 11 can be used to satisfy graduation requirements. It is designed as a four credit course with an estimated 90 to 110 hours of instructional content. This estimate is provided as a suggestion only; when delivering the prescribed curriculum, teachers may adjust the instructional time as necessary

RATIONALE FOR MODULES

The Science Module focusses on scientific knowledge and processes while the Technology Module focuses on technological applications. In turn, each of the modules integrates STES consistent with the Pan Canadian Science Framework. Selection of a minimum of two organizers from each module exposes students to both science and technology. Teachers are encouraged to include additional organizers as time and interest permits.

SCIENCE AND TECHNOLOGY 11 AT A GLANCE

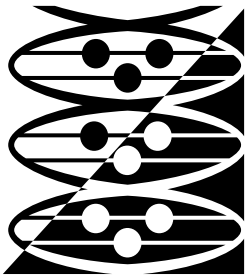
Science, technology, society, and the environment (STSE) – Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

Skills – Students will develop the skills required for scientific and technological inquiry, solving problems, communicating scientific ideas and results, working collaboratively, and making informed decisions.

Knowledge – Students will construct knowledge and understanding of concepts in life science, physical science, and Earth and space science, and apply their new understanding to interpret, integrate, and extend their knowledge.

Attitudes – Students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the benefit of self, society, and the environment.

Science Module	Technology Module
Choose a minimum of two organizers from the Science Module	Choose a minimum of two organizers from the Technology Module
Through study related to this organizer, students will come to understand	***Through study related to this organizer, students will come to understand***
Agriculture • the elements and issues related to agricultural systems • the tools and processes for producing and bringing food products to the consumer **Applied Chemistry** • the nature of many of the chemicals found around the home • issues related to the safe use and disposal of chemicals found around the home **Forensics** • the roles that science and technology play in solving crimes **Health** • the role technology plays in health issues • the influence of society on medical practices **Natural Resources and the Environment** • the technologies available to extract, process, and use natural resources in British Columbia • the need for effective management of resources and the issues related to their impact on the environment	**Computers and Communication** • the impact of the computer and other information and communications technology on both their personal lives and the ways in which they will have to work in the future • how better to gather, organize, and present information using electronic tools **Home and Technology** • the design, structure, materials, and legal aspects of requirements related to the construction of various types of home • technologies within the home and their impact on society **Personal Technologies** • the role of personal technologies in society **Space Exploration** • how science and technology dispel primitive concepts of cosmological structure • the limitations on advances in scientific knowledge acquired through space exploration **Transportation** • the technologies associated with transportation and their impact on society



CONSIDERATIONS FOR PROGRAM DELIVERY

Science and Technology 11

This section of the IRP contains additional information to help educators develop their school practices and plan their program delivery to meet the needs of all learners. Included in this section is information about:

- Alternative Delivery policy
- addressing local contexts
- involving parents and guardians
- course requirements respecting beliefs
- safety considerations
- confidentiality
- inclusion, equity, and accessibility for all learners
- working with the school and community
- working with the Aboriginal community
- information and communications technology
- copyright and responsibility

ALTERNATIVE DELIVERY POLICY

The Alternative Delivery policy does not apply to Science and Technology 11.

The Alternative Delivery policy outlines how students, and their parents or guardians, in consultation with their local school authority, may choose means other than instruction by a teacher within the regular classroom setting for addressing Prescribed Learning Outcomes contained in the Health curriculum organizer of the following curriculum documents:

- Health and Career Education K to 7
- Health and Career Education 8 and 9
- Planning 10

The policy recognizes the family as the primary educator in the development of children's attitudes, standards, and values, but the policy still requires that all Prescribed Learning Outcomes be addressed and assessed in the agreed-upon alternative manner of delivery.

It is important to note the significance of the term "alternative delivery" as it relates to the Alternative Delivery policy. The policy does not permit schools to omit addressing or assessing any of the Prescribed Learning Outcomes within the health and career education curriculum. Neither does it allow students to be excused from meeting any Prescribed Learning Outcomes related to health. It is expected that students who arrange for alternative delivery will address the health-related Prescribed Learning Outcomes and will be able to demonstrate their understanding of these Prescribed Learning Outcomes.

For more information about policy relating to alternative delivery, refer to: www.bced.gov.bc.ca/policy/

ADDRESSING LOCAL CONTEXTS

Science and Technology 11 includes opportunities for individual teacher and student choice in the selection of topics to meet certain Prescribed Learning Outcomes. This flexibility enables educators to plan their programs by using topics and examples that are relevant to their local context and to the particular interests of their students. When selecting topics it may be appropriate to incorporate student input.

INVOLVING PARENTS AND GUARDIANS

The family is the primary educator in the development of students' attitudes and values. The school plays a supportive role by focussing on the Prescribed Learning Outcomes in the Science and Technology 11curriculum. Parents and guardians can support, enrich, and extend the curriculum at home.

It is highly recommended that schools inform parents and guardians about the Science and Technology 11 curriculum. Teachers (along with school and district administrators) may use choose to do so by:

- informing parents/guardians and students of the Prescribed Learning Outcomes for the course
- responding to parent and guardian requests to discuss the course, unit plans, and learning resources

COURSE REQUIREMENTS RESPECTING BELIEFS

For many students and teachers, the study of some science concepts may lead to issues and questions that go beyond the immediate scope of curriculum (e.g., science is used to meet many industrial requirements, but industrial decision makers must consider factors other than scientific feasibility before adopting a particular process). The technological application of science in areas such as genetic engineering, human reproduction, and medical technology raises questions of ethics and values. Because these social questions arise, in part, from capabilities that science makes possible, they should be addressed. It must be made clear to students, however, that science only provides the background for what is hoped will be informed personal and social decisions. Teachers must handle these questions objectively and with sensitivity.

Reconciling scientific discoveries (for example, in age dating) and religious faith poses a particular challenge for some students. While respecting the personal beliefs of students, teachers should be careful to distinguish between knowledge based on the application of scientific methods, and religious teachings and associated beliefs such as creationism, theory of divine creation, or intelligent design theory.

SAFETY CONSIDERATIONS

Science education is an activity-based process that provides an exciting method of teaching and learning. However, experiments and demonstrations may involve inherent risks for both the teacher and the student. Safety guidelines must be discussed with students. These safety guidelines must support and encourage the investigative approach generally and laboratory instruction specifically, while at the same time promoting safety in the classroom and laboratory. Encouraging a positive safety attitude is a responsibility shared among the board, school administrators, teachers, and students in every school district. The co-operation of all these groups helps develop a strong safety consciousness both inside and outside our schools. Field work and field trips require special vigilance with respect to traffic and road safety, safe practices in study areas and when obtaining samples, and an awareness of changes in weather. Another important aspect of in-school safety is the Workplace Hazardous Materials Information Systems (WHMIS). Through labelling, material safety data sheets, and education and training, WHMIS is designed to ensure that those using hazardous materials have sufficient information to handle them safely. Each school district should have an individual trained in WHMIS who can work with teachers to establish safe, well-ventilated classroom and laboratory working conditions.

To assist teachers in providing a safe science-learning environment, the Ministry of Education publishes the Science Safety Resource Manual, which has been distributed to every school.

> The *Science Safety Resource Manual* is available online at: www.bced.gov.bc.ca/irp/resdocs/scisafety.htm

CONFIDENTIALITY

The *Freedom of Information and Protection of Privacy Act* (FOIPPA) applies to students, to school districts, and to all curricula. Teachers, administrators, and district staff should consider the following:

- Be aware of district and school guidelines regarding the provisions of FOIPPA and how it applies to all subjects, including Science and Technology 11.
- Do not use students' Personal Education Numbers (PENs) on any assignments that students wish to keep confidential.
- Ensure students are aware that if they disclose personal information that indicates they are at risk for harm, then that information cannot be kept confidential.
- Inform students of their rights under FOIPPA, especially the right to have access to their own personal information in their school records. Inform parents of their rights to access their children's school records.
- Minimize the type and amount of personal information collected, and ensure that it is used only for purposes that relate directly to the reason for which it is collected.
- Inform students that they will be the only ones recording personal information about

themselves unless they, or their parents, have consented to teachers collecting that information from other people (including parents).
- Provide students and their parents with the reason(s) they are being asked to provide personal information in the context of the Science and Technology 11 curriculum.
- Inform students and their parents that they can ask the school to correct or annotate any of the personal information held by the school, in accordance with Section 29 of FOIPPA.
- Ensure students are aware that their parents may have access to the schoolwork they create only insofar as it pertains to students' progress.
- Ensure that any information used in assessing students' progress is up-to-date, accurate, and complete.

For more information about confidentiality, refer to: www.mser.gov.bc.ca/privacyaccess/

INCLUSION, EQUITY, AND ACCESSIBILITY FOR ALL LEARNERS

British Columbia's schools include young people of varied backgrounds, interests, and abilities. The Kindergarten to Grade 12 school system focusses on meeting the needs of all students. When selecting specific topics, activities, and resources to support the implementation of Science and Technology 11, teachers are encouraged to ensure that these choices support inclusion, equity, and accessibility for all students. In particular, teachers should ensure that classroom instruction, assessment, and resources reflect sensitivity to diversity and incorporate positive role portrayals, relevant issues, and themes such as inclusion, respect, and acceptance.

Government policy supports the principles of integration and inclusion of students for whom English is a second language and of students with special needs. Most of the Prescribed Learning Outcomes in this IRP can be met by all students, including those with special needs and/or ESL needs. Some strategies may require adaptations to ensure that those with special and/or ESL needs can successfully achieve the Prescribed Learning Outcomes. Where necessary, modifications can be made to the Prescribed Learning Outcomes for students with Individual Education Plans (IEPs).

For more information about resources and support for students with special needs, refer to: www.bced.gov.bc.ca/specialed/

For more information about resources and support for ESL students, refer to: www.bced.gov.bc.ca/esl/

WORKING WITH THE SCHOOL AND COMMUNITY

This curriculum addresses a wide range of skills and understandings that students are developing in other areas of their lives. It is important to recognize that learning related to this curriculum extends beyond the science classroom.

School and district-wide programs and community organizations may support and extend learning in Science and Technology 11through the provision of locally developed learning resources, guest speakers, workshops, and field studies. Teachers may wish to draw on the expertise of these community organizations and members.

WORKING WITH THE ABORIGINAL COMMUNITY

The Ministry of Education is dedicated to ensuring that the cultures and contributions of Aboriginal peoples in BC are reflected in all provincial curricula. To address these topics in the classroom in a way that is accurate and that respectfully reflects Aboriginal concepts of teaching and learning, teachers are strongly encouraged to seek the advice and support of local Aboriginal communities. Aboriginal communities are diverse in terms of language, culture, and available resources, and each community will have its own unique protocol to gain support for integration of local knowledge and expertise. To begin discussion of possible instructional and assessment activities, teachers should first contact Aboriginal education co-ordinators, teachers, support workers, and counsellors in their district who will be able to facilitate the identification of local resources and contacts such as elders, chiefs, tribal or band councils, Aboriginal cultural centres,

Aboriginal Friendship Centres, and Métis or Inuit organizations.
In addition, teachers may wish to consult the various Ministry of Education publications available, including the "Planning Your Program" section of the resource, *Shared Learnings.* This resource was developed to help all teachers provide students with knowledge of, and opportunities to share experiences with, Aboriginal peoples in BC.

For more information about these documents, consult the Aboriginal Education web site: www.bced.gov.bc.ca/abed/welcome.htm

INFORMATION AND COMMUNICATIONS TECHNOLOGY

The study of information and communications technology is increasingly important in our society. Students need to be able to acquire and analyse information, to reason and communicate, to make informed decisions, and to understand and use information and communications technology for a variety of purposes. Development of these skills is important for students in their education, their future careers, and their everyday lives.

Literacy in the area of information and communications technology can be defined as the ability to obtain and share knowledge through investigation, study, instruction, or transmission of information by means of media technology. Becoming literate in this area involves finding, gathering, assessing, and communicating information using electronic means, as well as developing the knowledge and skills to use and solve problems effectively with the technology. Literacy also involves a critical examination and understanding of the ethical and social issues related to the use of information and communications technology. When planning for instruction and assessment in Science and Technology 11, teachers should provide opportunities for students to develop literacy in relation to information and communications technology sources, and to reflect critically on the role of these technologies in society.

COPYRIGHT AND RESPONSIBILITY

Copyright is the legal protection of literary, dramatic, artistic, and musical works; sound recordings; performances; and communications signals. Copyright provides creators with the legal right to be paid for their work and the right to say how their work is to be used. The law permits certain exceptions for schools (i.e., specific things permitted) but these are very limited, such as copying for private study or research. The copyright law determines how resources can be used in the classroom and by students at home.

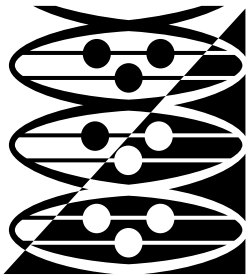
In order to respect copyright it is necessary to understand the law. It is unlawful to do the following, unless permission has been given by a copyright owner:

- photocopy copyrighted material to avoid purchasing the original resource for any reason
- photocopy or perform copyrighted material beyond a very small part—in some cases the copyright law considers it "fair" to copy whole works, such as an article in a journal or a photograph, for purposes of research and private study, criticism, and review
- show recorded television or radio programs to students in the classroom unless these are cleared for copyright for educational use (there are exceptions such as for news and news commentary taped within one year of broadcast that by law have record-keeping requirements – see the web site at the end of this section for more details)
- photocopy print music, workbooks, instructional materials, instruction manuals, teacher guides, and commercially available tests and examinations
- show video recordings at schools that are not cleared for public performance
- perform music or do performances of copyrighted material for entertainment (i.e., for purposes other than a specific educational objective)
- copy work from the Internet without an express message that the work can be copied

Permission from or on behalf of the copyright owner must be given in writing. Permission may also be given to copy or use all or some portion of copyrighted work through a licence or agreement. Many creators, publishers, and producers have formed groups or "collectives" to negotiate royalty payments and copying conditions for educational institutions. It is important to know what licences are in place and how these affect the activities schools are involved in. Some licences may also require royalty payments that are determined by the quantity of photocopying or the length of performances. In these cases, it is important to assess the educational value and merits of copying or performing certain works to protect the school's financial exposure (i.e., only copy or use that portion that is absolutely necessary to meet an educational objective).

It is important for education professionals, parents, and students to respect the value of original thinking and the importance of not plagiarizing the work of others. The works of others should not be used without their permission.

For more information about copyright, refer to www.cmec.ca/copyright/indexe.stm



PRESCRIBED LEARNING OUTCOMES

Science and Technology 11

Prescribed Learning Outcomes are content standards for the provincial education system; they are the prescribed curriculum. Clearly stated and expressed in measurable and observable terms, Prescribed Learning Outcomes set out the required knowledge, skills, and attitudes – what students are expected to know and be able to do – by the end of the course.

UNDERSTANDING THE PRESCRIBED LEARNING OUTCOMES

Schools have the responsibility to ensure that all Prescribed Learning Outcomes in the selected modules of this curriculum are met; however, schools have flexibility in determining how delivery of the curriculum can best take place.

It is expected that student achievement will vary in relation to the Prescribed Learning Outcomes. Evaluation, reporting, and student placement with respect to these outcomes are dependent on the professional judgment and experience of teachers, guided by provincial policy.

Prescribed Learning Outcomes for Science and Technology 11 are presented by module, and are coded alphanumerically for ease of reference; however, this arrangement is not intended to imply a required instructional sequence.

Wording of the Prescribed Learning Outcomes

All Prescribed Learning Outcomes complete the stem, "It is expected that students will…."

When used in a Prescribed Learning Outcome, the word "including" indicates that any ensuing item **must be addressed**. Lists of items introduced by the word "including" represent a set of minimum requirements associated with the general requirement set out by the outcome. The lists are not necessarily exhaustive, however, and teachers may choose to address additional items that also fall under the general requirement set out by the outcome.

DOMAINS OF LEARNING

Prescribed Learning Outcomes in BC curricula identify required learning in relation to one or more of the three domains of learning: cognitive, psychomotor, and affective. The following definitions of the three domains are based on Bloom's taxonomy.

The **cognitive domain** deals with the recall or recognition of knowledge and the development of intellectual abilities. The cognitive domain can be further specified as including three cognitive levels: knowledge, understanding and application, and higher mental processes. These levels are determined by the verb used in the Prescribed Learning Outcome, and illustrate how student learning develops over time.

- *Knowledge* includes those behaviours that emphasize the recognition or recall of ideas, material, or phenomena.
- *Understanding and application* represents a comprehension of the literal message contained in a communication, and the ability to apply an appropriate theory, principle, idea, or method to a new situation.
- *Higher mental processes* include analysis, synthesis, and evaluation. The higher mental processes level subsumes both the knowledge and the understanding and application levels.

The **affective domain** concerns attitudes, beliefs, and the spectrum of values and value systems.

The **psychomotor domain** includes those aspects of learning associated with movement and skill demonstration, and integrates the cognitive and affective consequences with physical performances.

PRESCRIBED LEARNING OUTCOMES: SCIENCE MODULE

Choose a minimum of two organizers from the Science Module.

It is expected that students will:

AGRICULTURE

A1 describe elements of agricultural systems found locally, provincially, and globally
A2 describe the role of genetics in agriculture
A3 evaluate different methods, including those from Aboriginal cultures, of food production, processing, and preservation
A4 analyse the effects of changing technology in agriculture on society

APPLIED CHEMISTRY

B1 classify chemicals commonly found in household products
B2 identify safe chemical disposal methods and compare them to common practices in the community
B3 design and conduct an experiment to identify and compare properties of household products and demonstrate an awareness of the health, safety, economic, and environmental issues related to their use
B4 synthesize a common household product

FORENSICS

C1 describe methods and technologies used to investigate a crime scene
C2 discuss how advances in technology have influenced the resolution of crimes
C3 collect evidence using forensic methodologies to solve a simulated crime

HEALTH

D1 describe how current medical technologies are used to address different types of illnesses with respect to transmission, detection, prevention, and treatment
D2 discuss the role of biology, chemistry, and physics in the development of modern medical technologies
D3 evaluate different societal perspectives on the development and use of medical technologies including:
- cultural
- local
- provincial
- national
- international

NATURAL RESOURCES AND THE ENVIRONMENT

E1 describe the major natural resources found in British Columbia
E2 evaluate methods used in the extraction, processing, use and management of a locally used or produced resource
E3 discuss the impact of society on natural resource management and the environment
E4 analyse the impact of technologies on the environment

PRESCRIBED LEARNING OUTCOMES: TECHNOLOGY MODULE

Choose a minimum of two organizers from the Technology Module.

It is expected that students will:

COMPUTERS AND COMMUNICATION

F1 use a computer to complete an assignment
F2 identify basic computer components and explain the integration and operating principles of the components
F3 describe the impact of science on the development of computers
F4 evaluate the impact of computers on society
F5 predict potential products and opportunities made possible by the development of computers

HOME AND TECHNOLOGY

G1 explain the basic scientific principles related to the structural integrity of shelters
G2 identify different types of indigenous shelters and the influence of local cultures and natural environment on their construction
G3 examine how science and technology advances have contributed to the design and construction of shelters
G4 discuss the role of building codes in the design and construction process
G5 examine current home technologies and describe how they impact family life and societal relations

PERSONAL TECHNOLOGIES

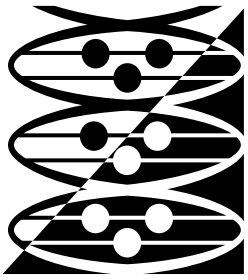
H1 investigate personal technologies currently used on a regular basis
H2 relate a current technology to pre-existing technologies
H3 describe how a personal technology integrates with a system

SPACE EXPLORATION

I1 identify recent contributions, including Canada's, to the development of space exploration technologies
I2 describe spin-offs resulting from space technologies and their impact on society
I3 illustrate how space conditions act as a limiting factor on space-based scientific knowledge
I4 predict future trends in technology related to space exploration

TRANSPORTATION

J1 describe the roles of transportation in society and the effects transportation has had on society
J2 identify key scientific and technological changes that have taken place in transportation
J3 analyse features incorporated into particular types of transportation
J4 describe a transportation system and evaluate its impact on society
J5 analyse a mode of transportation and the technologies associated with its design, construction, and operation



STUDENT ACHIEVEMENT

Science and Technology 11

This section of the IRP contains information about classroom assessment and student achievement, including specific achievement indicators to assist teachers in assessing student performance in relation to each Prescribed Learning Outcome. Also included in this section are Key Elements – descriptions of content that help determine the intended depth and breadth of Prescribed Learning Outcomes.

UNDERSTANDING THE KEY ELEMENTS

Key Elements provide an overview of content in each curriculum organizer. They can be used to determine the expected depth and breadth of the Prescribed Learning Outcomes.

UNDERSTANDING THE ACHIEVEMENT INDICATORS

To support the assessment of provincially prescribed curricula, this IRP includes sets of achievement indicators in relation to each Prescribed Learning Outcome. The achievement indicators are arranged by curriculum organizer for each module; however, this order is not intended to imply a required priority of module choice or a sequence of instruction and assessment.

Achievement indicators, taken together as a set, define the specific level of knowledge acquired, skills applied, or attitudes demonstrated by the student in relation to a corresponding Prescribed Learning Outcome. They describe what evidence to look for to determine whether or not the student has fully met the intent of the Prescribed Learning Outcome. Each achievement indicator defines only one aspect of the corresponding Prescribed Learning Outcome. It should be noted that the achievement indicators are designed to be considered as an entire set when determining whether students have fully met the Prescribed Learning Outcome.

In some cases, achievement indicators may also include suggestions as to the type of task that would provide evidence of having met the Prescribed Learning Outcome (e.g., a constructed response such as a list, comparison, analysis, or chart; a product created and presented such as a report, drama presentation, poster, letter, or model; a particular skill demonstrated such as interpreting graphs).

Achievement indicators support the principles of assessment *for* learning, assessment *as* learning, and assessment *of* learning. They provide teachers and parents with tools that can be used to reflect on what students are learning. As well as provide students with a means of self-assessment and ways of defining how they can improve their own achievement.

Achievement indicators are not mandatory; they are suggestions only, provided to assist in the assessment of how well students achieve the Prescribed Learning Outcomes.

Achievement indicators may be useful to provincial examination development teams and inform the development of exam items. However, examination questions, item formats, exemplars, rubrics, or scoring guides will not necessarily be limited to the achievement indicators as outlined in the Integrated Resource Packages.

Specifications for provincial examinations are available online at:
www.bced.gov.bc.ca/exams/specs/

CLASSROOM ASSESSMENT AND EVALUATION

Assessment is the systematic gathering of information about what students know, are able to do, and are working toward. Assessment evidence can be collected using a wide variety of methods, such as:

- observation
- student self-assessments and peer assessments
- quizzes and tests (written, oral, practical)
- samples of student work
- projects and presentations
- oral and written reports
- journals and learning logs
- performance reviews
- portfolio assessments

Assessment of student achievement is based on the information collected through assessment activities. Teachers use their insight, knowledge about learning, and experience with students, along with the specific criteria they establish, to make judgments about student performance in relation to Prescribed Learning Outcomes.

Three major types of assessment can be used in conjunction to support student achievement.

- Assessment **for** learning is assessment for the purpose of greater learning achievement.
- Assessment **as** learning is assessment as a process of developing and supporting students' active participation in their own learning.
- Assessment **of** learning is assessment for the purpose of providing evidence of achievement for reporting.

Assessment for Learning

Classroom assessment for learning provides ways to engage and encourage students to become involved in their own day-to-day assessment – to acquire the skills of thoughtful self-assessment and to promote their own achievement.

This type of assessment serves to answer the following questions:

- What do students need to learn to be successful?
- What does the evidence of this learning look like?

Assessment for learning is criterion-referenced, in which a student's achievement is compared to established criteria rather than to the performance of other students. Criteria are based on Prescribed Learning Outcomes, as well as on Suggested Achievement Indicators or other learning expectations.

Students benefit most when assessment feedback is provided on a regular, ongoing basis. When assessment is seen as an opportunity to promote learning rather than as a final judgment, it shows students their strengths and suggests how they can develop further. Students can use this information to redirect their efforts, make plans, communicate with others (e.g., peers, teachers, parents) about their growth, and set future learning goals.

Assessment for learning also provides an opportunity for teachers to review what their students are learning and what areas need further attention. This information can be used to inform teaching and create a direct link between assessment and instruction. Using assessment as a way of obtaining feedback on instruction supports student achievement by informing teacher planning and classroom practice.

Assessment as Learning

Assessment as learning actively involves students in their own learning processes. With support and guidance from their teacher, students take responsibility for their own learning, constructing meaning for themselves. Through a process of continuous self-assessment, students develop the ability to take stock of what they have already learned, determine what they have not yet learned, and decide how they can best improve their own achievement.

Although assessment as learning is student-driven, teachers can play a key role in facilitating how this assessment takes place. By providing regular opportunities for reflection and self-assessment, teachers can help students develop, practise, and become comfortable with critical analysis of their own learning.

Assessment of Learning

Assessment of learning can be addressed through summative assessment, including large-scale

assessments and teacher assessments. These summative assessments can occur at the end of the year or at periodic stages in the instructional process.

Large-scale assessments, such as Foundation Skills Assessment (FSA) and Graduation Program exams, gather information on student performance throughout the province and provide information for the development and revision of curriculum. These assessments are used to make judgments about students' achievement in relation to provincial and national standards. There is no large-scale provincial assessment for Science and Technology 11.

Assessment of learning is also used to inform formal reporting of student achievement.

For Ministry of Education reporting policy, refer to:

www.bced.gov.bc.ca/policy/policies/student_reporting.htm

Assessment *for* Learning	Assessment *as* Learning	Assessment *of* Learning
Formative assessment is *ongoing in the classroom*	**Formative assessment is *ongoing in the classroom***	**Summative assessment occurs *at end of year or at key stages***
• teacher assessment, student self-assessment, and/or student peer assessment • criterion-referenced – criteria based on Prescribed Learning Outcomes identified in the provincial curriculum, reflecting performance in relation to a specific learning task • involves both teacher and student in a process of continual reflection and review about progress • teachers adjust their plans and engage in corrective teaching in response to formative assessment	• self-assessment • provides students with information on their own achievement and prompts them to consider how they can continue to improve their learning • student-determined criteria based on previous learning and personal learning goals • students use assessment information to make adaptations to their learning process and to develop new understandings	• teacher assessment • may be either criterion-referenced (based on Prescribed Learning Outcomes) or norm-referenced (comparing student achievement to that of others) • information on student performance can be shared with parents/guardians, school and district staff, and other education professionals (e.g., for the purposes of curriculum development) • used to make judgments about students' performance in relation to provincial standards

For more information about assessment *for*, *as*, and *of* learning, refer to the following resource developed by the Western and Northern Canadian Protocol (WNCP): *Rethinking Assessment with Purpose in Mind.*

This resource is available online at: www.wncp.ca/

Criterion-Referenced Assessment and Evaluation

In criterion-referenced evaluation, a student's performance is compared to established criteria rather than to the performance of other students. Evaluation in relation to prescribed curriculum requires that criteria be established based on the Prescribed Learning Outcomes.

Criteria are the basis for evaluating student progress. They identify, in specific terms, the critical aspects of a performance or a product that indicates how well the student is meeting the Prescribed Learning Outcomes. For example, weighted criteria, rating scales, or scoring guides (reference sets) are ways that student performance can be evaluated using criteria.

Wherever possible, students should be involved in setting the assessment criteria. This helps students develop an understanding of what high-quality work or performance looks like.

Criterion-referenced assessment and evaluation may involve these steps:

Step 1	Identify the Prescribed Learning Outcomes and Suggested Achievement Indicators (as articulated in this IRP) that will be used as the basis for assessment.
Step 2	Establish criteria. When appropriate, involve students in establishing criteria.
Step 3	Plan learning activities that will help students gain the knowledge, skills, and attitudes outlined in the criteria.
Step 4	Prior to the learning activity, inform students of the criteria against which their work will be evaluated.
Step 5	Provide examples of the desired levels of performance.
Step 6	Conduct the learning activities.
Step 7	Use appropriate assessment instruments (e.g., rating scale, checklist, scoring guide) and methods (e.g., observation, collection, self-assessment) based on the particular assignment and student.
Step 8	Review the assessment data and evaluate each student's level of performance or quality of work in relation to criteria.
Step 9	Where appropriate, provide feedback and/or a letter grade to indicate how well the criteria are met.
Step 10	Communicate the results of the assessment and evaluation to students and parents/guardians.

SCIENCE MODULE

KEY ELEMENTS: AGRICULTURE

By the end of this organizer, students will understand the elements and issues related to agricultural systems and the tools and processes for producing and bringing food products to the consumer.

Vocabulary

agricultural runoff, antibiotic, arable land, canning, cloning, erosion, fertilizer, genetic modification, grafting, herbicide, hormone, husbandry, irradiation, irrigation, non-organic, organic, pesticide, pickling, salting, selective breeding, smoking, soil

Knowledge

- elements of an agricultural system
- agricultural technology
- nature of and reasons for genetic modification of food sources
- potential consequences of genetic modification
- standards for safe handling of food and agricultural products
- First Nations perspectives on food production

Skills and Attitudes

- understand agricultural activities from both urban and rural perspectives
- handle agricultural products and food in a safe manner
- analyse ethical issues related to agriculture practices

AGRICULTURE

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
A1 describe elements of agricultural systems found locally, provincially, and globally	❑ identify elements of a local agricultural system ❑ outline how a local agricultural system is similar to and different from one found elsewhere in Canada or the world ❑ recognize the importance of water and soil management to agriculture
A2 describe the role of genetics in agriculture	❑ identify plants and animals that have been genetically engineered ❑ describe efforts to genetically manipulate plants and animals and the effects this has on local agriculture (e.g., cloning, grafting, selective breeding, genetic modification) ❑ state possible reasons new varieties of plants and animals are being developed for public consumption
A3 evaluate different methods, including those from Aboriginal cultures, of food production, processing, and preservation	❑ identify standards set locally and provincially for the safe handling of food presented for local consumption ❑ describe different methods of processing food material (e.g., canning, irradiation, salting, smoking, pickling) ❑ evaluate different methods of processing or producing the same food product (e.g., irradiation vs. freezing, fish farming vs. wild stock) ❑ debate the pros and cons of organic vs. non-organic food production
A4 analyse the effects of changing technology in agriculture on society	❑ describe ethical concerns expressed by people not associated with farming about the production of food (e.g., slaughtering practices, pesticide/herbicide/fertilizer use, antibiotic/hormone use) ❑ explain how the role of the agricultural producer has changed over time ❑ debate the appropriateness of genetically modifying foods ❑ report on the impact of technology on the "family" farm

KEY ELEMENTS: APPLIED CHEMISTRY

By the end of this organizer, students will understand the nature of the various chemicals found around the home and issues related to the safe use and disposal of those chemicals.

Vocabulary

acid, additive, base, chemical property, combustible, corrosive, emulsifier, heterogeneous, homogeneous, infectious, mixtures, neutralization, pH, physical property, poisonous, silica gel, solution, suspension, toxic, Work Hazardous Materials Information System (WHMIS)

Knowledge

- WHMIS symbols and categories
- characteristics of hazardous chemicals found in the household
- environmental issues related to the use of some common household chemicals
- methods of safely disposing of household chemicals

Skills and Attitudes

- research a product
- recognize safety issues related to common household chemical products
- design and conduct experiments to safely test products
- develop and enhance various laboratory skills

APPLIED CHEMISTRY

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
B1 classify chemicals commonly found in household products	❑ identify chemicals commonly found in household products ❑ identify key elements in common household products (e.g., acids, bases) ❑ identify WHMIS symbols and describe the characteristics of substances that would be labelled with each symbol ❑ classify common household chemicals as toxic, poisonous, infectious, combustible, or corrosive
B2 identify safe chemical disposal methods and compare them to common practices in the community	❑ identify common practices for disposal of selected household products (e.g., paint, turpentine, engine oils, nail polish remover, silica gels, medicines) ❑ outline acceptable procedures for the safe disposal of selected classes of household chemicals ❑ recommend procedures that could be implemented in the community for safely disposing of toxic household chemicals
B3 design and conduct an experiment to identify and compare properties of household products and demonstrate an awareness of the health, safety, economic, and environmental issues related to their use	❑ research and report on the function of various components in cleaning agents ❑ test the pH levels of various household products ❑ identify environmental issues related to the use of some common household chemicals ❑ devise an advertising campaign aimed at informing the public of the risks associated with the use of various household chemicals ❑ design and conduct an experiment to identify and compare commercial cleaning products with environmentally friendly products
B4 synthesize a common household product	❑ identify ingredients found in common household products (e.g., soaps, cleaners, creams, toothpaste) ❑ research a method for the production of a common household product (e.g., soap, toothpaste) ❑ prepare a common household product (e.g. cold cream, mayonnaise, soap)

KEY ELEMENTS: FORENSICS

By the end of this organizer, students will understand the roles that science and technology play in the solving of crimes.

Vocabulary

chromatography, contamination, DNA, entomology, evidence, fingerprint, forensic evidence, microscope, poisonous, simulation, voice analysis, writing analysis, toxicology

Knowledge

- roles of technology in the collection of evidence
- methods of collecting evidence
- types of evidence collected and the reasons for collecting each type

Skills and Attitudes

- collect and process evidence safely
- process evidence using different laboratory techniques
- organize evidence
- report on evidence collected
- understand how to examine a crime scene using a variety of techniques
- differentiate between forensic science accepted in Canadian law courts versus media portrayal of forensic evidence

FORENSICS

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
C1 describe methods and technologies used to investigate a crime scene	❑ identify technologies that could be used to gather evidence at a crime scene ❑ describe procedures followed for successfully gathering any evidence available at a crime scene ❑ demonstrate competence in using technologies (e.g., microscopes, cultures, spectroscopes) to identify unknown substances (e.g., hair, fibres)
C2 discuss how advances in technology have influenced the resolution of crimes	❑ identify forensic techniques available in an historic crime (e.g., Jack the Ripper) ❑ discuss how contemporary forensic techniques have influenced previous crime investigations (e.g., David Milgaard) ❑ explain how technologies have been developed or adapted to collect evidence at a crime scene ❑ describe the types of forensic evidence which is admissible in Canadian courts
C3 collect evidence using forensic methodologies to solve a simulated crime	❑ watch a crime television show and identify forensic techniques used to solve the crime ❑ identify unknown substances using proper lab techniques ❑ describe the use of databases for suspect or victim identification (e.g., fingerprints, tattoos, DNA) ❑ apply forensic techniques and principles used to solve a simulated crime

KEY ELEMENTS: HEALTH

By the end of this organizer, students will understand the role technology plays in health issues and the influence of society on medical practices.

Vocabulary

anatomy, antibiotic, bacteria, body system, cells, communicable, Computerised (Axial) Tomography scan (CT scan or CAT scan), dialysis, disease, DNA, dormant, epidemic, genetic manipulation, human trials, immunization, infection, leech, magnetic resonance imaging (MRI), organ, pandemic, physiology, prosthesis, sexually transmitted infection (STI), tissue, transmission, virus

Knowledge

- medical technologies currently available and being used
- science principles upon which medical technologies are based
- processes of disease transmission
- processes used to detect diseases
- processes used to prevent the transmission of diseases
- processes used to treat diseases

Skills and Attitudes

- appreciate different viewpoints
- understand the importance of health related technologies
- understand the importance of healthy living to improve overall health

HEALTH

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
D1 describe how current medical technologies are used to address different types of illnesses with respect to transmission, detection, prevention, and treatment	❑ describe how diseases and illnesses can be transmitted within a population (e.g., STI, SARS, flu, food poisoning) ❑ list the technologies used to identify and treat basic types of illnesses (e.g., viral, bacterial, genetic) and injuries ❑ outline methods and technologies involved in the prevention of the transmission of various types of illnesses
D2 discuss the role of biology, chemistry, and physics in the development of modern medical technologies	❑ describe physics principles related to health technologies (e.g., prosthesis, imaging) ❑ describe the role of chemistry in developing health technologies (e.g., drugs, dialysis) ❑ describe how biology has impacted the development of health technologies (e.g., understanding cell physiology)
D3 evaluate different societal perspectives on the development and use of medical technologies including: - cultural - local - provincial - national - international	❑ describe the influence of traditional Aboriginal healing practices on modern medicine (e.g., leeching, aspirin) ❑ describe links between social behaviour, beliefs and norms and common illnesses and medical conditions ❑ identify issues that involve the application of medical technologies from various viewpoints (e.g., sex determination, genetic engineering, blood transfusion) ❑ debate the use of a specific medical technology

KEY ELEMENTS: NATURAL RESOURCES AND THE ENVIRONMENT

By the end of this organizer, students will understand the technologies available to extract, process, and use natural resources in British Columbia. Students will understand the need for effective management of resources and the issues related to their impact on the environment.

Vocabulary

environment, extraction, non-renewable energy, non-renewable resources, pollution, recycling, renewable energy, renewable resources, biodegradable

Knowledge

- methods involved in the extraction of a natural resource
- historical background related to natural resource extraction processes
- preparation of natural resources for public use
- technologies associated with natural resource extraction, processing, and use

Skills and Attitudes

- recognize the need to carefully manage all natural resources
- recognize the need to conserve natural resources including energy
- prepare and present arguments related to natural resources
- solve problems and think critically about a topic or position
- recognize the importance of recycling to reduce environmental impact
- recognize environmental impacts related to the extraction and use of energy resources

NATURAL RESOURCES AND THE ENVIRONMENT

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
E1 describe the major natural resources found in British Columbia	❑ identify the major natural resources found in BC ❑ classify BC's natural resources as renewable or non-renewable ❑ construct a timeline of natural resource utilization in BC
E2 evaluate methods used in the extraction, processing, use and management of a locally used or produced resource	❑ identify the major stakeholders in the management of natural resources ❑ explain how the extraction of a resource from the environment has changed over the past century ❑ describe how a given resource is prepared for public consumption or use ❑ debate the use of political control of the management of a given resource
E3 discuss the impact of society on natural resource management and the environment	❑ describe local and global environmental issues ❑ explain how the use of renewable and non-renewable energy resources has changed over time (e.g., solar power, electric cars, alternative fuels) ❑ relate how societal pressures influence the extraction process of a natural resource
E4 analyse the impact of technologies on the environment	❑ identify technologies associated with the extraction of a natural resource ❑ describe the link between a local environmental issue and the use of technology ❑ explore the relationship between the technology utilized for the extraction of a natural resource and its impact on the environment

TECHNOLOGY MODULE

KEY ELEMENTS: COMPUTERS AND COMMUNICATION

By the end of this organizer, students will understand the impact of the computer and other information and communications technologies on both their personal lives and the ways in which they will have to work. Students will have developed skills related to gathering, organizing, and presenting information using electronic tools.

Vocabulary

artificial intelligence, computer network, central processing unit (CPU), cathode-ray tube (CRT), database, diode, hardware, input, lasers, local area network (LAN), liquid crystal display (LCD), mainframe, metropolitan area network (MAN), media software, memory, nanotechnology, operating system, optics, output, personal computer (PC), random access memory (RAM), robotics, read-only memory (ROM), semi-conductors, software, spreadsheet, storage, transistors, triode, vacuum tube, virtual reality, wide area network (WAN), word processor

Knowledge

- computer parts and the function and operation of each
- information and communication technology tools and their impacts on our society
- basic science principles behind the operation of information and communication technology tools
- concerns related to the use of computers in our society

Skills and Attitudes

- project possible changes in our society based on the adoption of new technologies
- accept the use, limitations and potential of information and communication technology tools
- make appropriate use of information and communication technology tools to collect, manage and use information
- accept the changes brought about by the adoption of new technology

COMPUTERS AND COMMUNICATION

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
F1 use a computer to complete an assignment	❑ select appropriate software to complete an assignment ❑ complete an assignment using selected software ❑ submit an assignment using appropriate technology
F2 identify basic computer components and explain the integration and operating principles of the components	❑ distinguish between software and hardware ❑ describe the basic functional units of a computer (e.g., output, input, memory, processing) ❑ describe the flow of information between the basic functional units ❑ match different components of a computer with its function (e.g., CD-ROM and hard disk are storage, screens and printers are output, RAM is memory) ❑ identify appropriate uses of various software applications (e.g., presentation software, spreadsheets for finances, databases for organizing data)
F3 describe the impact of science on the development of computers	❑ list the branches of science involved in the development of computers ❑ identify key scientific discoveries that led to the development of computers (e.g., discovery of semi-conductors) ❑ describe the historical development of computer systems
F4 evaluate the impact of computers on society	❑ describe the impact computers have had on society over time (e.g., timeline activity, communication, accessing information) ❑ compare how the work environment has changed because of computers ❑ debate the value of the Internet as a source of information ❑ explain how a job or career has changed due to the development of computers (e.g., case studies related to computer technician jobs, reduction in the number of assembly line workers, changes in job descriptions)
F5 predict potential products and opportunities made possible by the development of computers	❑ describe emerging technologies made possible by computers (e.g., artificial intelligence, robotics, virtual reality) ❑ suggest the role of emerging computer-based technology in society ❑ predict a new computer-based technology and its impact on society

KEY ELEMENTS: HOME AND TECHNOLOGY

By the end of this organizer, students will understand the design, structure, materials and legal aspects of requirements related to the construction of various types of homes. Students will also have explored technologies within the home and their impact on society.

Vocabulary

alarm system, building code, building inspector, building materials, building permit, dwelling, engineered envelop, foundation, frame, green building, habitat, home theatre, igloo, insulation, kitchen appliance, longhouse, parallam beam, pre-fab, sealant, structural integrity, structural material, tepee, tensile strength, truss

Knowledge

- characteristics of various forms of structural materials
- structural changes that have been implemented in the design and construction of shelters over time
- parts of a building code and the need to have and adhere to a building code
- factors influencing construction
- changes in home technology

Skills and Attitudes

- think critically in relation to construction processes
- appreciate the importance of setting standards related to construction of homes
- understand home technology impacts on society
- apply a set of rules to a practical application

HOME AND TECHNOLOGY

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
G1 explain the basic scientific principles related to the structural integrity of shelters	❑ define tensile strength ❑ examine the load capacity of different structural forms (e.g., arch, triangle, square) ❑ compare and contrast different construction materials (e.g., wood, concrete, laminated wood, cement, brick)
G2 identify different types of indigenous shelters and the influence of local cultures and natural environment on their construction	❑ describe an indigenous shelter (e.g., igloo, longhouse, teepee) ❑ explain how indigenous shelters meet the challenges of natural environments ❑ explain the connections between local cultures, environment, and raw materials in the construction of shelters
G3 examine how science and technology advances have contributed to the design and construction of shelters	❑ list common technologies used in construction ❑ relate construction materials to construction techniques ❑ compare and contrast materials used for construction (e.g., parallam beams vs. steel beams, laminated vs. hard wood flooring, metal vs. wood studs) ❑ outline changes in construction practices (e.g., pre-fab, use of cordless tools, pneumatic tools)
G4 discuss the role of building codes in the design and construction process	❑ state reasons for a building code ❑ outline the components of a building code ❑ relate aspects of a building code to the region it applies to ❑ match components of a building code to an existing structure (e.g., classroom/portable, school, home) ❑ show the relationship between building codes and building permits
G5 examine current home technologies and describe how they impact family life and societal relations	❑ identify home technologies used to perform a routine task in a home ❑ compare current technologies to past technologies used in the home to complete a routine task ❑ critique the value of home technologies on family life and societal relations

KEY ELEMENTS: PERSONAL TECHNOLOGIES

By the end of this organizer, students will understand the role of personal technologies in society.

Vocabulary

cassette, CD player, DVD player, MP3 player, Personal Digital Assistant (PDA), phonograph, portable stereo system, power inverter, transistor, radio, record player, satellite phone, satellite radio, system, tuner, VCR, WiFi, cell phone, digital camera

Knowledge

- identify what a personal technology is
- identify what a system is
- describe the evolution of personal technologies

Skills and Attitudes

- predict future trends related to personal technologies
- use a personal technology as part of a system
- make informed decisions when purchasing personal technologies
- develop positive attitudes about personal technologies

PERSONAL TECHNOLOGIES

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
H1 investigate personal technologies currently used on a regular basis	❑ list personal technologies currently used on a regular basis (e.g., mobile phone, MP3 player, PDA, multimedia equipment) ❑ describe how personal technologies have transformed industries such as music, movies and other media ❑ describe the impacts of a personal technology on society ❑ predict future developments of a current personal technology ❑ describe the potential and the limitations of a personal technology
H2 relate a current technology to pre-existing technologies	❑ identify key scientific knowledge required to build a personal technology ❑ identify key pre-existing technologies that contributed to the development of a current personal technology ❑ compare and contrast a current personal technology to a similar pre-existing technology
H3 describe how a personal technology integrates with a system	❑ define a "technology system" (e.g., MP3 player or digital camera downloading audio or video information to a laptop) ❑ identify technologies associated with a system ❑ describe the function of each technological component in a system ❑ describe how each component works together to form a system

KEY ELEMENTS: SPACE EXPLORATION

By the end of this organizer, students will understand how science and technology dispel primitive concepts of cosmological structure. They will also understand how advances in scientific knowledge, acquired through space exploration, are limited.

Vocabulary

atrophy, Canadarm, computers, Copernicus, Einstein, Galileo, helio-centric, Kepler, nanotechnology, Newton, planetary system, Ptolemy, robotics, satellites, solstice, weightlessness

Knowledge

- cosmological structure and order
- limitations of scientific and technological innovations
- influence of technologies in one area on broader technological developments

Skills and Attitudes

- appreciate Canadian contribution to space exploration
- identify spin-off technologies

SPACE EXPLORATION

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
I1 identify recent contributions, including Canada's, to the development of space exploration technologies	❑ describe aboriginal beliefs, particularly those of BC First Nations, related to cosmological structures ❑ list astronomical concepts used before the scientific and technological age (e.g., Stonehenge, Mayan calendar, use of Polaris for navigation, Chinese prediction of lunar and solar eclipse) ❑ outline scientific and technological innovations, particularly those of recent Canadian origins, that contribute to our understanding of space (e.g., telescopes, parallax, Canadarm, filters)
I2 describe spin-offs resulting from space technologies and their impact on society	❑ give examples of "spin-off" technologies ❑ outline the development of some technologies that are spin-offs from space technologies (e.g., freeze dried foods, telecommunication satellites, IC chips) ❑ state positive and negative outcomes of a technology that is a spin-off from space exploration technologies (e.g., Star Wars, GPS, satelite maps)
I3 illustrate how space conditions act as a limiting factor on space-based scientific knowledge	❑ distinguish between healthy and unhealthy states in common organisms (e.g., physically fit, mentally sound) ❑ identify the consequences of untreated unhealthy states in some common organisms ❑ summarize the physiological effects resulting from organisms being exposed to space conditions (e.g., short day light hours, low gravity, atrophy, stunted growth) ❑ compare how experiments conducted in space may differ from those conducted on earth
I4 predict future trends in technology related to space exploration	❑ analyse the function of key components of systems that support space exploration ❑ infer how emerging technologies may contribute to space exploration (e.g., nanotechnology, gene-base data storage, superconductors) ❑ debate the value of developing space exploration technology in the context of contemporary societal issues (e.g., HIV vaccine, homelessness, global poverty) ❑ hypothesize solutions to the challenges of travel in space, (e.g. covering large distances, speed of light restriction, space hazards such as asteroids) ❑ explain how knowledge of Canada's Arctic may contribute to colonization of planetary bodies

KEY ELEMENTS: TRANSPORTATION

By the end of this organizer, students will understand the technologies associated with transportation and their impact on society.

Vocabulary

air bag, fuel cell, fuel injection, Global Positioning System (GPS), hybrid, infrastructure, internal combustion, LRT, mass transit, power cell, public transportation, steam engine, transportation system

Knowledge

- links between human populations and transportation
- safety issues related to the use of transportation
- technologies associated with different modes of transportation

Skills and Attitudes

- develop creative and critical thinking skills
- appreciate the value of features found in transportation
- use a scale to construct a model

TRANSPORTATION

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each corresponding Prescribed Learning Outcome.* *Students who have fully met the Prescribed Learning Outcome are able to:*
J1 describe the roles of transportation in society and the effects transportation has had on society	❑ identify how society uses different modes of transportation ❑ outline ways society has changed as a result of the evolution of transportation modes ❑ identify society's dependency on certain modes of transportation. (e.g., metropolitan area and LRT, suburban area and the car, business travel and the plane, commercial transport and trains) ❑ relate societal concern about issues related to transportation (e.g., cars and street racing, graduated drivers license and young drivers, trains and derailment, planes and new security measures for air travel, use of fossil fuel)
J2 identify key scientific and technological changes that have taken place in transportation	❑ describe key scientific and technological changes that have affected the development of transportation (e.g., wheel, steam engine, combustion engine, refining oil, anti-lock braking system (abs), suspension, rocketry) ❑ outline the historical developments of a given mode of transportation ❑ match key technologies associated with transportation to scientific principles used to develop each technology
J3 analyse features incorporated into particular types of transportation	❑ describe different features of a particular mode of transportation (e.g., GPS tracking, safety features, fuel hybridization, on board entertainment system, car phones) ❑ identify the key scientific principles behind features incorporated in a mode of transportation ❑ compare current features of a given mode of transportation to past features of a similar a mode of transportation (e.g., use of airbags in cars compared with seatbelts in cars, use of helmets by bicycle riders compared with no helmet use) ❑ compare and contrast a feature in different modes of transportation (e.g., air bags found in cars, but not buses, seatbelts found in cars, but not on boats) ❑ suggest how emerging technologies can be incorporated into a mode of transportation (e.g., safety features, new propulsion, alternate fuel)
J4 describe a transportation system and evaluate its impact on society	❑ describe society's concern before, during, and after the implementation of a transportation system ❑ examine a transportation system implemented in a particular community and describe its impact on that community ❑ identify infrastructure associated with a specific mode of transportation

STUDENT ACHIEVEMENT

PRESCRIBED LEARNING OUTCOMES	SUGGESTED ACHIEVEMENT INDICATORS
J5 analyse a mode of transportation and the technologies associated with its design, construction, and operation	❑ identify a component of a transportation mode and sequence its construction, from design to implementation (e.g., describe the design, construction and implementation of a LRT train car, or fuel cell, car engine) ❑ compare and contrast scientific principles and technological process that may be used to propel a mode of transportation ❑ suggest how emerging technologies may improve a mode of transportation ❑ design and construct a model mode of transportation (e.g., paper airplane, rubber band powered boat, CO_2 dragster)