

LITERACY FOUNDATIONS SCIENCE

Curriculum 2010

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LITERACY FOUNDATIONS WRITING AND PRODUCTION TEAM - 2007/08

Liora Beder	School District No. 36 (Surrey)
Monica Bergeron	School District No. 28 (Quesnel)
Louise Gallie	School District No. 40 (New Westminster)
Youash Gerwargis	School District No. 36 (Surrey)
Peter Grinberg	School District No. 73 (Kamloops/Thompson)
Melanie Hofer	School District No. 39 (Vancouver)
Malcolm James	School District No. 33 (Chilliwack)
Cherie Layne	School District No. 43 (Coquitlam)
James Mace	School District No. 39 (Vancouver)
Michelle Marcuzzi	School District No. 71 (Comox Valley)
Deirdre Morrison	School District No. 39 (Vancouver)
Heather Reidle	School District No. 71 (Comox Valley)
Rosalie Williams	School District No. 83 (North Okanagan-Shuswap)
Reber Creative	Editing and desktop publishing
Design & Communications	

LITERACY FOUNDATIONS PILOT SCHOOL DISTRICTS - 2008/09

School District No. 6 (Rocky Mountain)	Wayne Pelter - Principal, Continuing Education
School District No. 28 (Quesnel)	Ed Coleman - Principal, Continuing Education
School District No. 36 (Surrey)	Tara Holt - Principal, Continuing Education
	Barry Roberts - Principal, Continuing Education
	Ed Youngberg - Principal, Continuing Education
School District No. 38 (Richmond)	Mike Cairns - Vice-Principal, Continuing Education
	Michael Khoo - Director of Instruction, Continuing Education
School District No. 41 (Burnaby)	Louise Thorburn - Manager, Adult and Continuing Education Services
	Don Nordheimer - Principal, Continuing Education
School District No. 43 (Coquitlam)	Sarah Husband - District Principal, Continuing Education
School District No. 44 (North Vancouver)	Laurie Martin - Principal, Continuing Education
School District No. 61 (Victoria)	Kevin Luchies - Principal, Continuing Education

LITERACY FOUNDATIONS REVISION STEERING COMMITTEE - 2009/10

Ed Coleman	Principal, Continuing Education, School District No. 28 (Quesnel)
Charito Elderfield	Manager, Graduation Standards Unit, Ministry of Education
Steve Fleck	Principal, Continuing Education, School District No. 57 (Prince George)
Tara Holt	Principal, Continuing Education, School District No. 36 (Surrey)
Sarah Husband	Principal, Continuing Education, School District No. 43 (Coquitlam)
Kevin Luchies	Principal, Continuing Education, School District No. 61 (Victoria)
Paula Pothier	Education Officer, Ministry of Education
Louise Thorburn	Principal, Continuing Education, School District No. 41 (Burnaby)

LITERACY FOUNDATIONS REVISION TEAM - 2009/10

Monica Bergeron	School District No. 28 (Quesnel)
Connie Cirkony	Education Officer, Ministry of Education
Cynthia Coles	School District No. 57 (Prince George)
Richard DeMerchant	Education Officer, Ministry of Education
Adrienne Gnidec	Education Officer, Ministry of Education
Peter Grinberg	School District No. 73 (Kamloops)
Janine Hannis	Education Officer, Ministry of Education
Melanie Hofer	School District No. 39 (Vancouver)
Joanne Johnson	School District No. 36 (Surrey)
Cherie Layne	School District No. 43 (Coquitlam)
Robert Lazar	Education Officer, Ministry of Education
Glynis McGarva	School District No. 61 (Victoria)
Elizabeth McLenehan	School District No. 44 (North Vancouver)
Maureen McRae-Stanger	School District No. 44 (North Vancouver)
Kristin Mimick	Education Officer, Ministry of Education
Deirdre Morrison	School District No. 39 (Vancouver)
Vicki Ng	School District No. 41 (Burnaby)
Valerie Olteanu	School District No. 41 (Burnaby)
Virginia Rego	Education Officer, Ministry of Education
Julie-Anne Runge	School District No. 28 (Quesnel)
Connie Rushton	School District No. 57 (Prince George)
Kiley Sales	School District No. 28 (Quesnel)
Joanne Sear	School District No. 28 (Quesnel)
Joanne Shaw	School District No. 57 (Prince George)
Judi Stockley	School District No. 43 (Coquitlam)
Carol Topalian	School District No. 41 (Burnaby)

LITERACY FOUNDATIONS PRODUCTION - 2009/10

School District No. 57 (Prince George)	Web hosting of Moodle site for curriculum revision
Reber Creative Design & Communications	Editing and desktop publishing

INTRODUCTION

Literacy Foundations

The development of this curriculum has been guided by the following 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.

This document also recognizes that British Columbia's schools include individuals 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 learning outcomes. In addition, the following First Peoples principles of learning have been affirmed within First Peoples societies to guide the teaching and learning of provincial curricula:

- Learning ultimately supports the well-being of the self, the family, the community, the land, the spirits, and the ancestors.
- Learning is holistic, reflexive, reflective, experiential, and relational (focussed on connectedness, on reciprocal relationships, and a sense of place).
- Learning involves recognizing the consequences of one's actions.
- Learning involves generational roles and responsibilities.
- Learning recognizes the role of indigenous knowledge.
- Learning is embedded in memory, history, and story.
- Learning involves patience and time.
- Learning requires exploration of one's identity.
- Learning involves recognizing that some knowledge is sacred and only shared with permission and/or in certain situations.

Because these principles of learning represent an attempt to identify common elements in the varied teaching and learning approaches that prevail within particular First Peoples societies, it must be recognized that they do not capture the full reality of the approach used in any single First Peoples society.

RATIONALE

The aim of Literacy Foundations is to enable adults to develop knowledge and skills in five subject areas (English Language Arts, Mathematics, Science, Social Studies, and Information and Communications Technology) in order to be successful in courses required for graduation in either the Adult Graduation Program or the 2004 Graduation Program. The courses within each subject area of Literacy Foundations are bridging courses and provide standardized, competency-based Prescribed Learning Outcomes to address the literacy development needs of two main groups of adult students:

- **non-graduated adult students** who are functioning below the Grade 11 or 12 level in a given subject area and need to upgrade their skills and knowledge in preparation for entry into a graduation program (Adult Graduation Program or 2004 Graduation Program)
- **graduated adult students** who wish to take a Grade 11 or 12 level course to upgrade their graduation diploma but who are functioning below that level in a given subject area and need to upgrade their skills to enable them to successfully complete the course they have chosen to take

There is no requirement that students must take or that schools must offer any or all of the subject areas and courses within each subject area. Students can work with their school to determine which subject area(s) and course(s) within a subject area would best meet their needs.

Although Literacy Foundations addresses the needs of adult students, school-age students who have significant skill and knowledge gaps in any of the five subject areas of Literacy Foundations and need to upgrade their basic skills in order to be successful in coursework at the Grade 10, 11, and 12 levels may also benefit from some or all of the courses in Literacy Foundations.

REQUIREMENTS AND GRADUATION CREDITS

The Literacy Foundations courses within each subject area are coded as Grade 10 elective courses but are **not** creditable toward graduation. They are bridging courses that build the foundational skills necessary for students to successfully enter a graduation program.

Literacy Foundations courses cannot be considered equivalent to the Ministry Authorized K-9/10 curriculum as the Prescribed Learning Outcomes in the five Literacy Foundations subject areas do not contain all of the Prescribed Learning Outcomes found within the same subject areas of the Ministry Authorized K-9/10 curriculum. Successful completion of Literacy Foundations courses will not grant students equivalency for Grade 10 level Ministry Authorized courses. However, the Prescribed Learning Outcomes in the Literacy Foundations courses are sufficiently aligned with the Prescribed Learning Outcomes in the Ministry Authorized K-9/10 curriculum or the Ministry of Advanced Education's ABE (Adult Basic Education) Fundamentals curriculum to prepare adult learners to be successful in the courses required to obtain a graduation diploma.

Although the Literacy Foundations courses within each subject area are not creditable toward a graduation credential for either adult or school-age students, they are designated as four-credit courses for Ministry of Education reporting and funding purposes. Student achievement in Literacy Foundations courses must be reported in accordance with provincial policy.

There are no prerequisites for Ministry-Developed courses. Educators use their professional judgment in assessing students' ability to demonstrate the skills and knowledge necessary to achieve the Prescribed Learning Outcomes in a specific Literacy Foundations course/level.

SUGGESTED TIMEFRAME

The Literacy Foundations courses within each subject area typically contain 80 to 120 hours of instructional content. This estimate is provided as a suggestion only; when delivering the Prescribed

Learning Outcomes, teachers may adjust the instructional time as necessary to meet local school and student needs.

SUBJECT AREAS

Literacy Foundations contains the learning outcomes for the courses within each of the five following subject areas:

- English Language Arts
- Mathematics
- Science
- Social Studies
- Information and Communications Technology

To further clarify options and next steps for students as they move through and beyond the courses within the subject areas, introductory information and a diagram showing sample pathways is included in each of the subject areas. In particular, the sample pathways diagrams illustrate the following:

- suggested options for sequential skill-building as students progressively upgrade their knowledge and skills through the Literacy Foundations course(s) within a subject area (these are indicated by black arrows in the sample pathways diagrams);
- suggested options for moving from Literacy Foundations courses into courses for credit in either the Adult Graduation Program or the 2004 Graduation Program

The sample pathways are not prescriptive and are not intended to indicate that any course is a prerequisite for another.

However, students whose goals include pursuing post-secondary academic or trades education should be fully informed of specific prerequisite courses required for entry into the post-secondary program of their choice prior to selecting the pathway that will best meet their needs. Detailed information on BC post-secondary programs and requirements can be accessed on the British Columbia Council on Admissions and Transfer (BCCAT) website: www.educationplanner.ca.

PRESCRIBED LEARNING OUTCOMES

The Prescribed Learning Outcomes are the legally required content standards for the provincial education system. They define the required skills and knowledge for Literacy Foundations courses. The Prescribed Learning Outcomes are statements of what students are expected to know and be able to do by the end of each course within a subject area.

In comparison to the organization of the Prescribed Learning Outcomes outlined in the grade levels of provincial K-12 curriculum, the Prescribed Learning Outcomes of Literacy Foundations have been structured with the specific needs of the adult learner in mind. The essential question guiding the development of these Prescribed Learning Outcomes was: What does a student need to know and be able to do at each specific level in order to be successful at the next level?

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

For ease of reference, Prescribed Learning Outcomes are coded alphanumerically within each subject area; however, this arrangement is not intended to imply a required instructional sequence.

Wording of 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. These lists are not necessarily exhaustive, however; teachers may choose to address additional items that also fall under the general requirement set out by the outcome.

Conversely, the abbreviation "e.g.," (for example) in a Prescribed Learning Outcome indicates that the ensuing items are provided for illustrative purposes

or clarification, and are **not required**. Presented in parentheses, the list of items introduced by "e.g.," is neither exhaustive nor prescriptive, nor is it put forward in any special order of importance or priority. Teachers are free to substitute items of their own choosing that they feel best address the intent of the learning outcome.

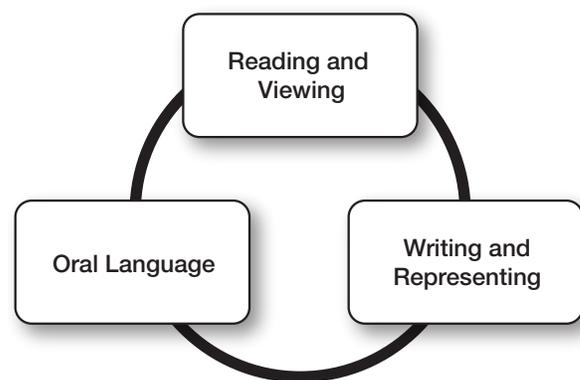
STRATEGIES FOR SUPPORTING LITERACY LEARNING WITHIN THE SUBJECT AREAS

All teachers, at all grades, teaching all subjects are teachers of literacy. Teachers do not just teach content knowledge but also ways of reading, writing, and oral expression specific to that subject area. Language allows students to make connections across many areas of study.

What is literacy? Literacy is "the ability to understand and employ printed information in daily activities, at home, at work and in the community – to achieve one's goals and to develop one's knowledge and potential."

- *The International Adult Literacy and Life Skills Survey (IALLS), 2005*

The ability to read is a cornerstone for success in education, work, and life; literacy is the essential skill upon which all other learning depends. It is expected that students enrolled in Literacy Foundations will experience greater success in these courses when there is a focus on reading, writing, and oral language development across all subject areas with the goals of comprehension and understanding.



More time for literacy learning does not mean less time for learning other subjects. In fact, literacy learning provides a way into the increasingly complex ideas and texts that students encounter in all subject areas as they advance through the levels and grades. By integrating literacy learning and adapting instruction to respond to the diverse literacy needs of their students, all subject teachers:

- prepare students to read, write, and comprehend subject area-specific material;
- provide students with opportunities to practise and apply literacy skills and strategies in many different contexts; and
- can better support success for all learners.

British Columbia's education system supports the principles of integration, equity, accessibility, and inclusion for students of all backgrounds, interests, and abilities. Literacy challenges should not be a barrier to students; therefore, the Ministry of Education encourages teachers to consider a variety of instructional and assessment strategies that embed and support literacy learning.

The following are examples of strategies that support literacy learning throughout the Literacy Foundations subject areas. They are not grade-specific but rather suggestions that can be adapted to the particular learning situation.

Ways that teachers can support students to develop oral language skills:

- Assign roles for small group discussion (e.g., leader, recorder, timer, mediator, and presenter).
- Teach, model, and reinforce appropriate listening and speaking behaviours.
- Create a variety of situations where students can use oral language to express ideas, information, and emotions (e.g., speeches, storytelling, debates).
- Teach listening strategies designed to focus attention on identifying the main purpose or theme in informational and literary texts.
- Model how making connections to prior knowledge, making predictions, and evaluating ideas are important listening skills.

Ways that teachers can support students with reading and viewing skills:

- Read and identify features of both informational and literary texts (e.g., illustrations, glossary, and table of contents).
- Identify purpose for reading, model "reading-between-the-lines" to make inferences, and use context to find meaning.
- Demonstrate and teach use of graphic organizers (e.g., in Science, use bar graphs, line graphs, pie charts, tables, and diagrams to extract and convey information; in Math, draw pictures to portray a problem or flow charts to outline the steps to solve a problem; in Social Studies, use timelines to illustrate a sequence of events and charts to compare systems).
- Use a variety of reading strategies, including skimming, scanning, rereading, making predictions, and making connections (e.g., in Science, identify main points that support or refute information and bias in an article; in Math, identify extraneous information in a word problem).
- Identify subject-specific vocabulary (e.g., in Information and Communications Technology, perform internet searches using efficient research skills such as use of keywords/vocabulary; in Science, create a dictionary with plain language definitions of common terminology).

Ways that teachers can support students with writing and representing skills:

- Model the writing process: pre-writing (generate ideas, identify purpose and audience), writing (develop and organize ideas, support the main idea), post-writing (edit and revise)
- Teach subject-specific vocabulary for content, skills, and processes (e.g., in Science, use class time to create subject-specific dictionary and provide simple definitions).
- Teach and model conventions of writing such as grammar, punctuation, spelling, content, style, and form (e.g., in Social Studies, develop criteria for essay writing and have students proof and edit their own work).
- Demonstrate strategies to generate ideas, such as brainstorming, discussion, and visualizing, and mapping and other organizers.

- Explore the features and conventions of various forms of writing (e.g., in English Language Arts, students can write letters, travel journals, résumés, or short stories).

Ways that teachers can support students to demonstrate evidence of thinking:

- Model how to ask questions (e.g., in Information and Communications Technology, students can develop questions to assess web content for reliability; in Math, students can develop questions to determine steps to solve a word problem).
- Create space for ambiguity and various points of view (e.g., in Social Studies, students can explore “what-if” or alternative historic scenarios; in English Language Arts, students can read a variety of poems or essays on one theme or topic and compare and contrast the ideas presented).
- Encourage students to think independently and to expand thinking (e.g., in Science, students can apply theories to new problems; in Social Studies, students can study current events and propose approaches to social or civic issues; in English Language Arts, students can select reading materials based on their own goals or interests).

Resources:

The following resources are starting points to learn more about literacy strategies and other considerations that can assist teachers designing educational programs for students:

- English Language Arts integrated resource packages and curriculum
- BC Performance Standards (reading, writing)
- Secondary literacy strategies:
 - *Teaching Students with Learning and Behavioural Differences: A Resource Guide for Teachers*
 - *Students with Intellectual Disabilities: A Resource Guide for Teachers*
 - *Students from Refugee Backgrounds: A Guide for Teachers and Schools*
- Literacy specialist and English Language Arts teachers in your school or district
- *Shared Learnings: Integrating BC Aboriginal Content K-10* (2006)

INCLUSION, EQUITY, AND ACCESSIBILITY FOR ALL LEARNERS

British Columbia’s schools include people of varied backgrounds, interests, and abilities. When selecting specific topics, activities, and resources to support the implementation of Literacy Foundations, 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 taking English as a Second Language (ESL) and of students with special needs. Some strategies may require adaptations to ensure that those with special and/or ESL needs can successfully achieve the Prescribed Learning Outcomes.

Some students with special needs may require program adaptation or modification to facilitate their achievement of the learning outcomes identified in Literacy Foundations.

INFUSING ABORIGINAL CONTENT

The Ministry of Education is dedicated to ensuring that the cultures and contributions of Aboriginal peoples in BC are reflected in all provincial curricula.

Authentic Texts and Resources

In order to present authentic First Peoples content and worldviews, it is important to draw from Aboriginal learning and teaching resources. Authentic First Peoples texts are those that:

- present authentic First Peoples voices, i.e., historical or contemporary texts created by First Peoples (or through the substantial contributions of First Peoples)
- depict themes and issues important to First Peoples cultures (e.g., loss of identity and affirmation of identity, tradition, healing, role of family, importance of Elders, connection to the land, the nature and place of spirituality as

an aspect of wisdom, the relationships between individual and community, the importance of oral tradition, the experience of colonization and decolonization)

- incorporate First Peoples story-telling techniques and features as applicable (e.g., circular structure, repetition, weaving in of spirituality, humour).

Due to the diversity of Aboriginal communities in BC, Canada and the world, and the need to provide a relevant context to classroom instruction and assessment, it is suggested that resource selection focuses primarily on First Peoples texts and resources from the local community wherever possible.

Working with the Aboriginal Community

To address Aboriginal content and perspectives 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. As Aboriginal communities are diverse in terms of language, culture, and available

resources, 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, First Nations 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

LITERACY FOUNDATIONS: AT A GLANCE

The aim of Literacy Foundations is to enable adults to upgrade their knowledge and skills in five subject areas in order to be successful in courses required for graduation in either the Adult Graduation Program or the 2004 Graduation Program. Students can work with their school to determine which courses within the five subject areas outlined below would best meet their needs. There is no requirement that students must take or that schools must offer any or all of the courses within each subject area.

Literacy Foundations English Language Arts

CORE COURSES

- Literacy Foundations English Language Arts Level 1: Core
- Literacy Foundations English Language Arts Level 2: Core
- Literacy Foundations English Language Arts Level 3: Core
- Literacy Foundations English Language Arts Level 4: Core
- Literacy Foundations English Language Arts Level 5: Core
- Literacy Foundations English Language Arts Level 6: Core
- Literacy Foundations English Language Arts Level 7: Core

*COMPANION COURSES

- Literacy Foundations English Language Arts Level 1/2: Companion - Speaking and Listening
- Literacy Foundations English Language Arts Level 1/2: Companion - Reading
- Literacy Foundations English Language Arts Level 3/4: Companion - Reading
- Literacy Foundations English Language Arts Level 3/4: Companion - Writing
- Literacy Foundations English Language Arts Level 5/6/7: Companion - Writing

**Companion courses are designed to supplement the Prescribed Learning Outcomes of the Literacy Foundations English Language Arts core courses.*

Literacy Foundations Mathematics

COURSES

- Literacy Foundations Mathematics Level 1
- Literacy Foundations Mathematics Level 2
- Literacy Foundations Mathematics Level 3
- Literacy Foundations Mathematics Level 4
- Literacy Foundations Mathematics Level 5
- Literacy Foundations Mathematics Level 6: Apprenticeship and Workplace
- Literacy Foundations Mathematics Level 6: Math Foundations
- Literacy Foundations Mathematics Level 7: Apprenticeship and Workplace
- Literacy Foundations Mathematics Level 7: Math Foundations

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Literacy Foundations Science

COURSES

- Literacy Foundations Science: Biology
- Literacy Foundations Science: Chemistry
- Literacy Foundations Science: Physics

Literacy Foundations Social Studies

COURSE

- Literacy Foundations Social Studies

Literacy Foundations Information and Communications Technology

COURSE

- Literacy Foundations Information and Communications Technology

LITERACY FOUNDATIONS

Science

INTRODUCTION

Literacy Foundations (LF) Science comprises three courses, one for each of the disciplines of biology, chemistry, and physics. The Prescribed Learning Outcomes in these three courses define the specific knowledge, skills, and attitudes that students are expected to achieve. The curriculum organizers for each course include

- LF Science: Biology
 - Processes of Science
 - Diversity of Life
 - Cells
 - Systems
 - Immune System
 - Cell Division
 - Reproduction
- LF Science: Chemistry
 - Processes of Science
 - Properties of Matter
 - Atomic Theory
 - The Periodic Table
 - Chemical Formulae
 - Ionic and Covalent Bonding
 - Acids, Bases, and Salts
 - Organic and Inorganic Compounds
 - Chemical Reactions
- LF Science: Physics
 - Processes of Science
 - Motion
 - Forces
 - Energy
 - Electricity
 - Optics

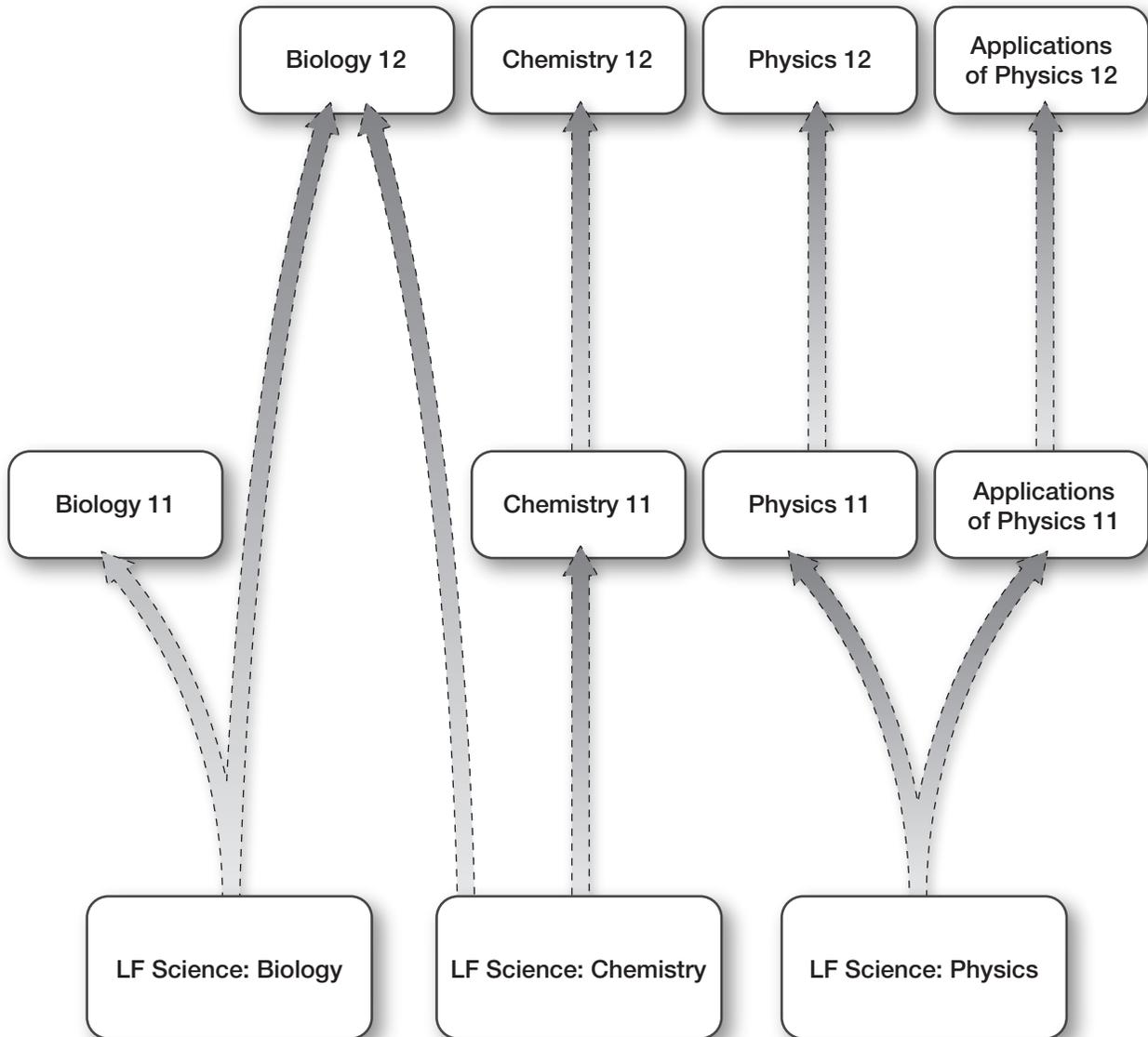
The aim of LF Science is to help students develop the knowledge and skills needed to be successful in Biology 11 or 12, Chemistry 11 and 12, and Physics 11 and 12. LF Science courses are appropriate for graduated or non-graduated students who have not been enrolled in a science course for many years or who have not taken any science courses at the secondary level. Although senior science courses are not required in the Adult Graduation Program, students may need to complete one or more in order to satisfy prerequisite admission requirements for the post-secondary academic/trades program of their choice.

The LF Science courses support students in acquiring the foundational knowledge and skills needed for success in senior level science courses. Additionally, it is recommended that prior to taking Grade 11 and 12 Science courses, students complete or are able to demonstrate the mathematical skills equivalent to the LF Mathematics Level 7: Math Foundations course.

The LF Science courses are not appropriate for students intending to graduate with the 80-credit graduation diploma (Dogwood Diploma) as Science 10 is a required course in this graduation program. The LF Science courses do not prepare students to meet the Prescribed Learning Outcomes for Science 10.

The sample pathways diagram on the following page illustrates the various course options that students may select in order to move progressively toward their particular goal.

LITERACY FOUNDATIONS SCIENCE SAMPLE PATHWAYS



Literacy Foundations Science: Biology

PROCESSES OF SCIENCE

It is expected that students will:

- A1 demonstrate an understanding of safe procedures in science (e.g., use of lab equipment, techniques for the handling and disposal of lab materials, emergency response procedures)
- A2 demonstrate an understanding of the steps involved in using the scientific method (e.g., hypothesis, prediction, variables, observation, data interpretation, conclusion, communication)
- A3 represent and interpret scientific information in graphic form
- A4 demonstrate the qualities of a scientifically literate person (e.g., ability to identify assumptions, ability to distinguish fundamental concepts from irrelevant information, a recognition that scientific knowledge is continually developing and often builds upon previous theories)
- A5 describe the relationship between science and technology
- A6 demonstrate competence in using technologies (e.g., microscopes, internet) specific to investigative procedures and research

DIVERSITY OF LIFE

It is expected that students will:

- B1 identify various characteristics of living things (e.g., ability to reproduce, grow, respire, use energy, respond to stimuli)
- B2 distinguish among Plantae, Animalia, Monera, Protista, and Fungi as kingdoms of life
- B3 classify organisms according to their characteristics (i.e., using a descriptive key)
- B4 compare the characteristics of living things to viruses
- B5 identify adaptations of various life forms (e.g., colouration, mimicry)
- B6 propose a plausible explanation of how particular adaptations help life forms interact in their environment

CELLS

It is expected that students will:

- C1 summarize cell theory (e.g., recognize that all living things are composed of cells, and all cells come from pre-existing cells)
- C2 identify cell organelles (e.g., cell membrane, nucleus, cytoplasm, mitochondrion, cell wall, chloroplast, vacuole, ribosome) and describe the function of each
- C3 list similarities and differences between plant, animal and bacteria cell types
- C4 identify parts of a cell using a microscope or diagrams
- C5 differentiate between osmosis and diffusion in the transporting of materials across cell membranes

SYSTEMS

It is expected that students will:

- D1 define the following terms: tissue, organ, and organ system
- D2 distinguish between the structure and function of cells, tissues, organs, and organ systems
- D3 explain the relationship among cells, tissues, organs, and organ systems
- D4 identify the main components of human organ systems (e.g., respiratory, circulatory, digestive, excretory)
- D5 describe how organ systems work together to obtain and transport nutrients, remove wastes, and exchange gases

Literacy Foundations Science: Biology

IMMUNE SYSTEM

It is expected that students will:

- E1 describe the role of the immune system and its three defence systems (i.e., primary, secondary, and tertiary)
- E2 identify components of the primary defence systems, including skin, tears, ear wax, saliva, gastric juice, cilia, and mucous
- E3 identify phagocytic white blood cells as the major component of the secondary defence system
- E4 identify white blood cells that produce antibodies as the major component of the tertiary defence system
- E5 describe how each of the defence system components works (e.g., skin prevents bacteria from entering the body, phagocytic white blood cells engulf and destroy viruses and bacteria, and white blood cells produce antibodies that combine with antigens)
- E6 describe how pathogens (e.g., E. coli, influenza viruses, HIV) and toxins (e.g., botulism) affect body systems

CELL DIVISION

It is expected that students will:

- F1 identify the contents of the nucleus (e.g., chromosomes, DNA, genes, nucleolus)
- F2 explain the significance of cell division, with reference to the basic relationship between genes and proteins (i.e., gene code for proteins)
- F3 describe, in sequence, the stages and features of the cell cycle, including mitosis and cytokinesis
- F4 demonstrate an understanding that cancer is a process of abnormal cell division
- F5 distinguish meiosis from mitosis in terms of the number of chromosomes and daughter cells resulting from each process

REPRODUCTION

It is expected that students will:

- G1 distinguish between male and female gametes
- G2 describe the process by which a single zygote forms (i.e., fertilization) and develops
- G3 distinguish between sexual (e.g., human) and asexual reproduction (e.g., binary fission, budding, vegetative fragmentation) in organisms
- G4 relate sexual and asexual reproduction to adaptability of organisms (e.g., adaptability to environmental conditions)

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PROCESSES OF SCIENCE

It is expected that students will:

- A1 demonstrate an understanding of safe procedures in science (e.g., use of lab equipment, techniques for the handling and disposal of lab materials, emergency response procedures)
- A2 demonstrate an understanding of the steps involved in using the scientific method (e.g., hypothesis, prediction, variables, observation, data interpretation, conclusion, communication)
- A3 represent and interpret scientific information in graphic form
- A4 demonstrate the qualities of a scientifically literate person (e.g., ability to identify assumptions, ability to distinguish fundamental concepts from irrelevant information, a recognition that scientific knowledge is continually developing and often builds upon previous theories)
- A5 describe the relationship between science and technology
- A6 demonstrate competence in the use of equipment and technologies (e.g., balances, graduated cylinders, thermometers, internet) specific to investigative procedures and research

PROPERTIES OF MATTER

It is expected that students will:

- B1 identify physical properties of matter, including mass, volume, density, state at room temperature, colour, melting/boiling point, and conductivity
- B2 differentiate between physical and chemical changes
- B3 describe changes of state of matter and how they relate to kinetic molecular theory

ATOMIC THEORY

It is expected that students will:

- C1 distinguish between atoms and molecules
- C2 identify the three subatomic particles, their properties, and their location within the atom (e.g., by creating models or drawing diagrams)

THE PERIODIC TABLE

It is expected that students will:

- D1 explain the importance of atomic number, atomic mass, properties, and families to the organization of the periodic table of elements
- D2 define isotope in terms of atomic number and mass number
- D3 distinguish among metals, non-metals, and metalloids
- D4 use the periodic table to predict the properties of a family of elements (e.g., alkali, alkaline earth metals, halogens, noble gases)

CHEMICAL FORMULAE

It is expected that students will:

- E1 differentiate between elements and compounds
- E2 write chemical symbols for atoms and ions of elements
- E3 differentiate between atoms and ions in terms of structure (e.g., using Bohr models)
- E4 write chemical formulae for ionic compounds, including those involving metals with non-metals, multivalent metals, and polyatomic ions
- E5 name ionic compounds based on the chemical formula of each

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IONIC AND COVALENT BONDING

It is expected that students will:

- F1 define and give examples of ionic bonding (e.g., metal and non-metal) and covalent bonding (e.g., two non-metals)
- F2 draw a Bohr model (i.e., including protons and electrons) of each atom up to atomic number 20
- F3 identify valence electrons using the periodic table (i.e., excluding lanthanides and actinides)
- F4 draw and interpret Lewis diagrams showing single bonds for ionic compounds and covalent molecules (e.g., NaCl, MgO, BaBr₂, H₂O, CH₄, NH₃)
- F5 distinguish between lone pairs and bonding pairs of electrons in molecules

ACIDS, BASES, AND SALTS

It is expected that students will:

- G1 explain the significance of the pH scale, with reference to common substances
- G2 define the following terms: acids, bases and salts
- G3 differentiate between acids, bases, and salts with respect to chemical formulae and properties
- G4 identify the names and formulae of common acids (e.g., hydrochloric, sulphuric, nitric, acetic)
- G5 using prefixes up to "deca," convert the names of covalent compounds to formulae and vice versa

ORGANIC AND INORGANIC COMPOUNDS

It is expected that students will:

- H1 define the following terms: organic compounds and inorganic compounds
- H2 distinguish between organic and inorganic compounds based on their chemical structures

CHEMICAL REACTIONS

It is expected that students will:

- I1 describe the law of conservation of mass
- I2 balance chemical equations
- I3 classify chemical formulae in terms of their type of chemical reactions, including synthesis (combination), decomposition, single and double replacement, neutralization (acid-base), and combustion
- I4 explain how factors such as temperature, concentration, presence of a catalyst, and surface area can affect the rate of chemical reactions

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PROCESSES OF SCIENCE

It is expected that students will:

- A1 demonstrate an understanding of safe procedures in science (e.g., use of lab equipment, techniques for the handling and disposal of lab materials, emergency response procedures)
- A2 demonstrate an understanding of the steps involved in using the scientific method (e.g., hypothesis, prediction, variables, observation, data interpretation, conclusion, communication)
- A3 represent and interpret scientific information in graphic form
- A4 demonstrate the qualities of a scientifically literate person (e.g., ability to identify assumptions, ability to distinguish fundamental concepts from irrelevant information, a recognition that scientific knowledge is continually developing and often builds upon previous theories)
- A5 describe the relationship between science and technology
- A6 demonstrate competence in the use of equipment and technologies (e.g., timing devices, voltmeter, mirrors and lenses, internet) specific to investigative procedures and research

MOTION

It is expected that students will:

- B1 describe displacement in relation to change in position, (Δx), time interval (Δt), and velocity (v_{av})
- B2 analyse a graph showing the relationship between displacement and time interval for an object travelling in uniform motion
- B3 use the formula $v_{av} = \Delta x / \Delta t$ to calculate the average velocity (v_{av}), displacement, change in position, (Δx), and time interval (Δt) for an object in uniform motion
- B4 describe acceleration in relation to the concepts of positive, negative, zero
- B5 give examples of positive, negative, and zero acceleration (i.e., in relation to falling objects, accelerating from rest, slowing down or stopping, and uniform motion)
- B6 use the formula $a = \Delta v / \Delta t$, where $\Delta v = v_f - v_i$ to calculate acceleration (e.g., for falling objects), given initial velocity (v_i), final velocity (v_f), and the time interval (Δt)

FORCES

It is expected that students will:

- C1 describe the concept of force (i.e., push or pull of one object on another) and differentiate among the different types (e.g., magnetic, friction, gravitational, elastic, electrical)
- C2 differentiate between mass (i.e., the amount of matter that makes up an object) and weight (i.e., the amount of pulling force that gravity exerts on an object)
- C3 describe the movement of objects in terms of balanced and unbalanced forces
- C4 describe friction as a force that opposes motion (i.e., including air resistance)

ENERGY

It is expected that students will:

- D1 identify energy as the capacity of a physical system to perform work
- D2 differentiate among various forms of energy (e.g., gravitational, kinetic, thermal, potential, light)
- D3 describe the law of conservation of energy

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ELECTRICITY

It is expected that students will:

- E1 explain (e.g., verbally, with drawings) how static charges are separated because of transfer of electrons between various materials
- E2 differentiate between the two types of static electrical charge (i.e., positive, negative) and no charge (i.e., neutral) with reference to atomic theory
- E3 distinguish between potential and kinetic energy, static electricity and electric current, and conventional current and electron flow
- E4 describe the concept of current in terms of the amount of electric charge that passes a point in a given time interval
- E5 define resistance as the force that opposes the flow of electric current
- E6 demonstrate an understanding of circuits by drawing circuit diagrams that include properly placed and appropriate symbols
- E7 perform calculations using Ohm’s Law
- E8 differentiate between series and parallel circuits in terms of current, voltage, and total resistance given a fixed supply voltage
- E9 describe electrical energy and power
- E10 calculate power using voltage and current data
- E11 calculate energy consumption given the power rating of a device and duration of use

OPTICS

It is expected that students will:

- F1 define the concept of waves and describe their characteristics (e.g., using examples and sketches)
- F2 describe the concept of wavelength in relation to frequency and amplitude
- F3 differentiate among radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays in terms of wavelength, frequency, and energy transferred
- F4 demonstrate an understanding of how visible light is reflected (e.g., relate angle of incidence and angle of reflection for curved and plane mirrors)
- F5 demonstrate an understanding of how visible light is refracted (e.g., bending of rays, changes of speed, diverging and converging lenses)
- F6 describe problems that can occur in human vision (e.g., near-sighted, far-sighted) and how they can be corrected through use of eyeglasses, contacts, and corrective eye surgery