Guidelines for Developing Modified Courses

Science 11 (Basic)

Saskatchewan Education

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Purpose

These guidelines for Science 11 reflect the renewed Science 10 curriculum (2005). The previous document included guidelines for Science 11, 21, and 31. This document only addresses guidelines for Science 11; guidelines for Science 21 and 31 remain the same as in the previous document.

Introduction

Students are required to complete one Science course at the 10 level and one at either the 20 or 30 level for graduation. Some students may not be able to complete a regular provincially developed course even though adaptations to curriculum materials and topics, instruction, and the learning environment have been made. This may require the development of a modified course to meet student needs.

One of the cornerstones of Core Curriculum is the provision for Locally-determined Options, as specified in *Core Curriculum: Principles, Time Allocations, and Credit Policy* (2000). At the Secondary Level, this allows school divisions to develop courses or modify regular courses to meet student needs. **These courses must be approved and registered by Saskatchewan Education to ensure that students receive proper credit.**

Locally modified courses of study may be of two types:

a) A Locally Modified (**Basic**) Course of Study is defined as a course where 50% of the course is determined by Saskatchewan Learning through basic objectives listed from the provincial curriculum and the remaining 50% of the course is determined by the school division. The objectives determined by the school division may include learning objectives from previous grades and other areas of study. In many cases, locally chosen objectives are used to develop students' knowledge, skills, and abilities in order to prepare students for achieving the basic objectives from the provincial curriculum guide. In other cases, locally chosen objectives are used to extend students' understanding, skills, and abilities in areas related to the basic objectives listed from the curriculum guides. Modified basic courses (11, 21, 31) can be used to fulfil requirements in the required courses of study, specified areas of study, and electives. Modified courses (Basic) may not be accepted as entrance requirements at post-secondary institutions.

b) A Locally Modified (**Advanced**) Course of Study is defined as a course where a portion of the time is used to meet all of the department prepared curriculum objectives and up to 50% of the time is used to meet additional (more advanced) objectives as determined by the school division. Modified courses (10A, 20A, 30A) can be used to fulfil requirements in the required courses of study, specified areas of study, and electives.

Details outlining the policy and application process can be found in *Policy and Procedures for Locally Modified Courses of Study* (Saskatchewan Learning, 2007).

In keeping with the intent of Core Curriculum, modified courses exhibit a number of characteristics:

- **Objectives** must be listed.
- **Core** content will be emphasized with modifications expressed through objectives to a basic or advanced level.
- The **Common Essential Learnings** will be incorporated.
- The **Adaptive Dimension** will be used as appropriate by emphasizing a wide range of instructional and evaluation approaches to support student achievement of course

objectives.

- The modified course will reflect the principles of Core Curriculum including
  - Gender Equity
  - Multiculturalism
  - Career Development
  - Aboriginal perspectives and
  - Resource-based Learning.

Planning

The aim of the Science program, regular or modified, is to graduate students who are scientifically literate. Scientific literacy is an evolving combination of the science-related **attitudes**, **skills**, and **knowledge** students need to develop inquiry, problem-solving, and decision-making abilities; to become lifelong learners; and to maintain a sense of wonder about the world around them.

A scientifically literate person is able to distinguish science from pseudoscience, evidence from propaganda, fact from fiction, knowledge from opinion, theory from dogma, and data from myth and folklore (Hurd, 1998).

Diverse learning experiences based on the objectives will provide students with many opportunities to explore, analyze, evaluate, synthesize, appreciate, and understand the interrelationships among science, technology, society, and the environment (**STSE**) that will affect students' personal lives, their careers, and their futures.

Although the particular context of these learning experiences will vary among classrooms, the overall scope and focus of science instruction will include a balance of the following broad instructional contexts:

- **Scientific inquiry**, in which students address questions about the nature of things, involving broad exploration as well as focused investigations.

- **Technological problem-solving**, in which students seek answers to practical problems requiring the application of their science knowledge in new ways.

- **STSE decision-making**, in which students identify questions or issues and pursue scientific knowledge that will inform the question or issue.

- **Cultural and Indigenous Knowledge**, in which students recognize and respect knowledge systems that various cultures have developed to understand the natural world and technologies that were created to solve human problems.

Each of these instructional contexts provides a potential starting point for engaging in an area of exploration within a science course. These studies may involve a variety of learning approaches for exploring new ideas, for developing specific investigations, and for applying the ideas that are learned.

To achieve the vision of scientific literacy, students must increasingly become engaged in the planning, development, and evaluation of their own learning activities. In the process, students should have the opportunity to work collaboratively with others, to initiate investigations, to communicate findings, and to complete projects that demonstrate learning.

In light of the vision for scientific literacy and the need to develop scientifically literate students in Canada, four foundational statements delineate the critical aspects of students' scientific literacy. The foundational and related learning objectives for each of the units of study derive from these four foundational areas.

Foundation 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.

Foundation 2: 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.

Foundation 3: 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.

Foundation 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.

Specific **Learning Objectives** have been selected as minimum requirements for a Modified Basic course in Science. In addition, Modified Basic courses should focus on practical applications of scientific knowledge that are relevant to the student's everyday world. A Modified Advanced course is to provide additional academic challenges beyond the learning objectives in the regular provincial course. Factors such as an individual student's aptitude, interest, learning styles, and future plans will determine the additional advanced objectives that need to be addressed.

The regular Secondary Science courses are organized around units from the disciplines of life science, physical science, and earth and space science.

Background

To assist with completion of Form M-1 for Modified course submission, it is recommended that you refer to the following Saskatchewan Education documents:

- *Science 10: Curriculum Guide* (2005)
- *Science 10: A Bibliography* (2005)
- *Learning Resources Update* (2006)
- *Policy and Procedures for Locally Modified Courses of Study* (2007)
- *The Adaptive Dimension in Core Curriculum* (1992)
- *Instructional Approaches: A Framework for Professional Practice* (1991)
- *Student Evaluation: A Teacher Handbook* (1991)
- *Saskatchewan School-Based Program Evaluation Resource Book* (1989)
- *Common Essential Learnings: A Handbook for Teachers* (1988).

Approval

Contact your Regional Superintendent of Curriculum and Instruction for a copy of Form M-1 or access it at the following location: http://www.sasked.gov.sk.ca/docs/policy/ldcaep/p29-32.pdf

Science 11 (Basic)

These guidelines for Science 11 have been chosen to reflect the units of the renewed Science 10 (2005) curriculum. The basic objectives for Science 11 have been chosen from each of the four units of Science 10 in order to accommodate students who: 1) receive credit for Science 11 while in the same classroom as students who receive credit for Science 10, and 2) students who are enrolled in a classroom that consists solely of modified students (Science 11, Science 11/21, or Science 11/21/31).

Each of the four required units should receive approximately the same amount of instructional time. No particular sequence of units is suggested although teachers may want to consider scheduling the Sustainability of Ecosystems unit in either early fall or late spring to accommodate outdoor visits to ecosystems.

Unit planning guidelines from the Science 10 curriculum (pp. 23-24) should guide the development of Science 11.

Required Learning Objectives

Unit A: Sustainability of Ecosystems

Foundational and Learning Objectives

SE1 - Explore cultural perspectives on sustainability

1. Examine how various cultures view the relationships between living organisms and their ecosystems. (PSD, CD 9.3)
3. Select and integrate information from various human, print, and electronic sources (government publications, community resources, and personally collected data) with respect to sustainability and the environment. (COM, NUM)

SE2 - Examine biodiversity within local ecosystems

1. Observe and document a range of organisms to illustrate the biodiversity within a local ecosystem.
2. Select and use apparatus and materials safely when documenting biodiversity.
3. Identify biotic and abiotic components of an ecosystem.
4. Explain how the biodiversity of an ecosystem contributes to its sustainability.
5. Identify energy flow in ecosystems using the concept of the pyramid of energy, numbers, or biomass. (NUM)
9. Demonstrate a sense of personal and shared responsibility for maintaining a sustainable environment. (PSD)
12. Explore ecology-related work settings and work roles in the community. (CD 5.2)

SE3 - Analyze population dynamics within an ecosystem

1. Explain various ways in which natural populations maintain equilibrium and relate this equilibrium to the resource limits of an ecosystem.
4. Discuss the ethics of studying biotic components of ecosystems. (CCT, COM)

SE4 - Identify cycles, change, and stability in ecosystems

1. Illustrate the cycling of nutrients and matter through biotic and abiotic components of an ecosystem by tracking carbon, nitrogen, and oxygen.
3. Identify and respect various cultural perspectives on the cycling of nutrients and matter through the environment. (CCT)

SE5 - Investigate human impact on ecosystems

2. Compare a natural and a disturbed (altered) ecosystem and suggest ways of assuring their sustainability.
5. Propose a course of action on social issues related to sustainability, taking into account

human and environmental needs. (IL, PSD, TL)
6. Predict the personal, social, and environmental consequences of a proposed action. (PSD)
7. Defend a decision or judgement and demonstrate that relevant arguments can arise from different perspectives. (CCT, COM)

Unit B: Chemical Reactions

Foundational and Learning Objectives

CR1 Observe common chemical reactions in your world

1. Provide examples of how science and technology are an integral part of our lives and community. (TL)
2. Observe and describe chemical reactions that are important in everyday life.
3. Perform activities to investigate exothermic and endothermic chemical reactions.
4. Identify indicators that provide evidence that a chemical reaction has likely taken place.
5. Show concern for safety and accept the need for rules and regulations when conducting scientific investigations. (PSD)
6. Demonstrate knowledge of Workplace Hazardous Materials Information System (WHMIS) standards by selecting and applying proper techniques for handling and disposing of lab materials.

CR2 Represent chemical reactions symbolically using models, word equations, and balanced chemical equations

1. Represent common chemical compounds using models.
2. Name and write formulas for common ionic compounds using the periodic table and a list of ions. (COM)
3. Name and write formulas for common molecular compounds using the periodic table and a list of numerical prefixes.
7. Represent chemical reactions using word equations.
9. Represent chemical reactions and conservation of mass using models.

CR3 Identify characteristics of chemical reactions involving organic compounds

1. Observe and describe the combustion process.
4. Propose alternative solutions to society's reliance on fossil fuels, identify the potential strengths and weaknesses of each solution, and select one as the basis for a plan. (CCT, PSD)

CR4 Identify factors that affect the rates of chemical reactions

1. Identify how factors such as temperature, concentration, and surface area can affect the rate of a chemical reaction.
3. Design and perform an experiment to determine how various factors affect chemical reaction rates, identifying and controlling major variables. (CCT)
4. Carry out procedures controlling the major variables and adapting or extending procedures where required.
5. Compile and organize data, using appropriate formats and data treatments to facilitate interpretation of the data. (COM, NUM)

CR5 Investigate chemical reactions involving acids and bases

1. Perform activities to investigate the characteristics of acids and bases. (IL)
2. Work co-operatively with team members to develop and carry out a plan, and troubleshoot problems as they arise. (CD 2.3)
4. Classify substances as acids, bases, or salts, based on observable characteristics, name, and chemical formula.

6. Describe the process of neutralization and identify practical examples.

Unit C: Motion in Our World

Foundational and Learning Objectives

MW1 Explore motion-related technologies

1. Acquire, with interest and confidence, additional science knowledge and skills using a variety of resources and methods, and adopt behaviours and attitudes that project a positive self-image. (PSD, CD 1.3)

Each student should achieve ***at least one*** of the following objectives:

5. Evaluate the design and function of a motion-related technology using identified criteria such as safety, cost, availability, and impact on everyday life and the environment. (CCT, PSD)
8. Describe examples of Canadian contributions to science and technology in motion-related fields such as transportation, sport science, or space science. (TL)

MW2 Observe and describe the motion of everyday objects

1. Observe and describe the motion of everyday objects qualitatively using personal words and phrases. (COM)
2. Categorize the motion of everyday objects as uniform and non-uniform. (CCT)

MW3 Investigate the relationship among distance, time, and speed for objects that undergo uniform motion

1. Collect data about everyday objects that undergo simple linear motion. (NUM)
2. Design an experiment and identify specific variables to be tested. (TL)
3. Develop appropriate sampling procedures for data collection in an experiment. (NUM)
4. Use appropriate instruments such as ticker timers, stopwatches, photogates, or motion detectors to collect data effectively and accurately.
7. Construct distance-time graphs to represent the uniform motion of everyday objects. (NUM)

MW4 Investigate the relationship among speed, time, and acceleration for objects that undergo uniformly accelerated motion

1. Collect data about everyday objects that undergo uniformly accelerated motion. (NUM)
2. Work collaboratively to plan and carry out investigations, as well as to generate and evaluate ideas to practice the skills, knowledge, and attitudes needed to work effectively with and for others. (PSD, CD 2.3)
3. Construct and analyze distance-time and speed-time graphs of objects that undergo uniform acceleration. (NUM)
4. Describe quantitatively the relationship among speed, time, and acceleration.
5. Select and use appropriate vocabulary, units, symbols, and graphs to communicate information about moving objects. (COM)

MW5 Analyze graphically and mathematically the relationship among distance, speed, time, and acceleration for objects that undergo simple linear motion or uniformly accelerated motion

1. Describe quantitatively the relationship among distance, time, speed, and acceleration for everyday objects that undergo simple linear motion (uniform motion or uniformly accelerated motion).
8. Read and interpret graphs to develop an understanding of the relationships among numbers. (NUM)

Unit D: Weather Dynamics

Foundational and Learning Objectives

WD1 Explore the causes and impact of severe weather in Canada

1. Identify and explain those characteristics that distinguish weather from climate. (CCT)
2. Identify and explain the causes of Canadian severe weather events (e.g., tornadoes, hurricanes, blizzards, hailstorms, thunderstorms, flooding, ice storms, and droughts).
3. Identify tools scientists use to describe and classify severity of weather phenomenon (i.e., Beaufort wind scale, Saffir-Simpson Hurricane Scale, wind chill chart, humidex, UV index). (TL)

WD2 Analyze meteorological data

3. Express meteorological data qualitatively and quantitatively. (NUM)
5. Display meteorological data in a variety of formats including diagrams, tables, charts, and graphs. (NUM)
6. Analyze meteorological data for a given time span using appropriate methodologies and technologies.

WD3 Explain the principles of weather

3. Explore cultural and historical views on the origins and interpretations of weather. (PSD)
4. Identify and describe the characteristics of the atmosphere, hydrosphere, and lithosphere.
5. Describe and explain heat transfer within the water cycle.
12. Show understanding of ideas by providing alternate phrasing, drawings and diagrams, modeling, writing, etc. (COM)

WD4 Forecast local weather conditions

1. Examine the principles of weather prediction and predict local weather conditions, using qualitative and quantitative methods. (NUM)
2. Determine the accuracy of local weather predictions for a given period. (CCT)
5. Explore various cultural and historical perspectives related to weather forecasting.

WD5 Identify consequences of global climate change

1. Identify current issues related to global climate change. (PSD)
2. Identify the most important natural and human factors that influence global climate. (TL)
3. Examine and evaluate evidence that climate change occurs naturally. (CCT)
5. Select and integrate information related to global climate change from various print and electronic sources. (COM)
7. Discuss potential consequences of climate change and the need to investigate climate change.

Other Units/Objectives - the 50% of the locally determined course

The 50% of the locally determined course may be developed in a number of ways:

- Add additional objectives from the Science 10 curriculum.
- Develop new objectives for any or all of the four required units that meet students' needs.
- Develop an additional unit or units that meet students' needs.

Alternatively, students may need most of the course time allocation to achieve the 50% departmentally determined objectives with local basic objectives added to build students' knowledge and skills (so that department-determined objectives can be achieved).

Teachers may ask the Regional Office(s) to provide samples of exemplary modified basic courses.

Resources

Key resources are recommended in *Science 10: A Bibliography* (2005). Learning Resources Updates recommend many supplementary resources. Teachers should choose resources that are appropriate to meet learner needs.