

Reference Document

Companion Guide to the Science Programs

Référence document

Companion Guide to the Science Programs

Formation professionnelle et technique
et formation continue

Direction de la formation générale
des adultes

© Gouvernement du Québec
Ministère de l'Éducation, du Loisir et du Sport, 2005 — 05-00556

ISBN 2-550-45362-X (version imprimée)
ISBN 2-550-45363-8 (PDF)

Legal Deposit—Bibliothèque nationale du Québec, 2005

Authors	Jacky Tremblay	Commission scolaire des Découvreurs
	Pauline Pelletier	Commission scolaire de la Seigneurie-des-Mille-Îles
	Pierrette Marcotte	Consultant
Translation		Services à la communauté anglophone
		Direction de la production en langue anglaise
English version Consultant	Ann Anderson	Consultant
Science Program Coordinator	Pauline Pelletier (since 2003)	Direction de la formation générale des adultes
	Pierrette Marcotte (until 2003)	Direction de la formation générale des adultes
Program Coordinator	Marc Leduc	Direction de la formation générale des adultes
Director	Alain Mercier	Direction de la formation générale des adultes

Table of Contents

General Introduction to the Guide	1
Part I: Administrative Information	3
<i>Physical Science Program: Secondary IV</i>	5
Introduction	5
Program Structure	5
Course Descriptions	6
Lab Activities	7
Students Targeted	7
Prerequisites	7
Relationship With Previous Programs	7
Equivalences in the Youth Sector Program	8
Noncumulative Courses	8
Evaluation	9
Learning Materials	9
<i>Chemistry Program: Secondary V</i>	11
Introduction	11
Program Structure	11
Course Descriptions	12
Lab Activities	13
Students Targeted	13
Prerequisites	14
Relationship With Previous Programs	14
Equivalences in the Youth Sector Program	15
Noncumulative Courses	15
Evaluation	15
Learning Materials	16
<i>Physics Program: Secondary V</i>	17
Introduction	17
Program Structure	17
Course Descriptions	18
Lab Activities	19
Students Targeted	20
Prerequisites	20
Relationship With Previous Programs	20
Equivalences in the Youth Sector Program	21
Noncumulative Courses	21
Evaluation	22
Learning Materials	23
<i>Biology: Secondary V</i>	25
Introduction	25
Program Structure	25
Course Descriptions	26
Lab Activities	29
Students Targeted	29
Prerequisites	29

Relationship With the Previous Program-----	29
Equivalences in the Youth Sector Program-----	30
Noncumulative Courses-----	30
Evaluation-----	31
Learning Materials-----	32
Part II: Pedagogical Information-----	33
Types of Course Objectives and Their Characteristics-----	35
<i>Physical Science Program: Secondary IV</i> -----	35
<i>Chemistry Program: Secondary V and Physics Program: Secondary V</i> -----	36
<i>Biology: Secondary V</i> -----	38
STS Approach to <i>Physical Science Program: Secondary IV</i> -----	39
HTS Perspective on <i>Chemistry Program: Secondary V and Physics Program: Secondary V</i> -----	41
Skills Associated With the Experimental Method— <i>Chemistry Program: Secondary V and Physics Program: Secondary V</i> -----	45
Characteristics and Methods of Evaluation-----	49
Formative Evaluation-----	49
Summative Evaluation-----	50
Definition of the Domain for Summative Evaluation-----	50
Responsibility for Developing Examinations-----	51
Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education-----	51
Local Policy on the Evaluation of Learning-----	52
Specifications Concerning Summative Evaluation-----	53
<i>Physical Science Program: Secondary IV</i> -----	53
<i>Chemistry Program: Secondary V and Physics Program: Secondary V</i> -----	55
<i>Biology: Secondary V</i> -----	58
Learning Materials-----	61
Labs and Lab Materials-----	63
Harmonization With Youth Sector Programs-----	65
Secondary IV Physical Science Programs-----	66
Secondary V Chemistry Programs-----	69
Secondary V Physics Programs-----	72
APPENDIX-----	75
Table 1-----	77
Table 2-----	78
Table 3-----	79
Table 4-----	80
Table 5-----	81
Table 6-----	82
Table 7-----	83
Table 8-----	84
Table 9-----	85
Table 10-----	86
Table 11-----	87

General Introduction to the Guide

This document is intended for everyone involved in teaching sciences in Secondary Cycle Two in general education in the adult sector. It contains administrative and pedagogical information on *Physical Science Program: Secondary IV*, *Chemistry Program: Secondary V*, *Physics Program: Secondary V* and *Biology: Secondary V*, published by the Direction de la formation générale des adultes (DFGA) between 1996 and 2004. This information complements that found in the programs themselves and in the *Definition of the Domain for Summative Evaluation* for each of the courses.

Part I of this document has four chapters, one for each program. Each chapter presents, in the same order, information required to organize teaching, review a student's record, create a student's learning profile, and recognize and certify learning achievement. In addition, there is an introduction to the program, a description of its structure and the courses that comprise it, the requirements for lab activities, the students targeted, prerequisite courses, the relationship with the previous programs, a description of how the adult sector program corresponds to the youth sector program, as well as information on noncumulation, evaluation and learning materials.

Part II complements Part I, in that it includes more detailed information on different aspects of teaching. The information is arranged by subject, and not by program, as is the case in Part I. It has chapters on the types of course objectives and their characteristics, the *Science-Technology-Society* (STS) approach to the Physical Science program, the *History-Technology-Society* (HTS) perspective on the Chemistry and Physics programs, the development of skills associated with the experimental method, evaluation methods and their characteristics, a summative evaluation for each course, learning materials, the physical design of labs, and a chapter describing how each program is harmonized with the corresponding program in the youth sector.

Summary tables are presented in the Appendix.

Finally, it should be noted that all information is current as of the date of publication of this document.

Part I: Administrative Information

Physical Science Program: Secondary IV

INTRODUCTION

Physical Science Program: Secondary IV is a general education program for adult students enrolled in Secondary Cycle Two.

In addition to teaching concepts, this program is designed to broaden the scientific knowledge of adult students and lead them to develop the cognitive skills that form a repertoire of strategies essential to a person's everyday activities. The program relies on an instructional approach known as *Science–Technology–Society* (STS), which stresses the impact of scientific phenomena on technology and society. For this reason, less emphasis is placed on the development of skills associated with the experimental method in the Secondary IV Physical Science program than in the Secondary V Chemistry and Physics programs.

The printed version of *Physical Science Program: Secondary IV* was distributed to all educational institutions in October 1997. Copies can be obtained from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Physical Science Program: Secondary IV

Title	Date of Publication	Document Code
<i>Physical Science Program: Secondary IV</i>	October 1997	38-8312-A

Physical Science Program: Secondary IV was first published in French as *Sciences Physiques, 4^e secondaire* (38-8312).

PROGRAM STRUCTURE

Physical Science Program: Secondary IV consists of three courses with a similar structure and approach that complement one another but have no hierarchical relationship. The courses may be taken in any order. This interdependence makes it easier to organize courses and teach groups of students when the situation calls for it.

Each course is a 50-hour course and counts for two Secondary IV credits toward the Secondary School Diploma (SSD).

Courses in *Physical Science Program: Secondary IV*

Code	Title	Hours	Credits
PSC-4010-2	Nuclear Technology: A Matter of Energy	50	2
PSC-4011-2	Electricity: What's the Connection?	50	2
PSC-4012-2	Ionic Phenomena: A Study of an Environmental Problem	50	2

COURSE DESCRIPTIONS

Each of the courses is structured around a unifying theme. Below is a brief description of the content of each course.

PSC-4010-2 Nuclear Technology: A Matter of Energy

The course on nuclear energy deals with the major scientific principles associated with the fundamental relationship between matter and energy. It focuses on the atomic structure and the classification of elements. Students learn about the evolution of knowledge that enabled human beings to channel nuclear energy. The course also familiarizes students with the various applications of nuclear energy in the energy, medical and military fields. In the social sphere, the course raises the issue of the use of nuclear energy, notably to produce electricity.

PSC-4011-2 Electricity: What's the Connection?

The course on electricity presents the principles underlying electrical phenomena. It examines the concepts of static electricity, dynamic electricity, magnetism and electromagnetism. It covers electric circuits and the steps involved in the production and use of electricity. In the social sphere, it aims to make students think about the consequences of the use of electricity as well as the implications of the choice of a particular method of producing it. It enables the students to evaluate issues brought about by political choices made to satisfy the growing demand for electricity.

PSC-4012-2 Ionic Phenomena: A Study of an Environmental Problem

The course on ionic phenomena focuses on the principal concepts and phenomena related to chemistry, which students must know about, for example, to understand the problem of acid rain or that of water pollution caused by fertilizers and pesticides. It presents the atomic model and the periodic table of the elements. It considers the chemical bonds leading to the formation of compounds such as acids, bases and salts. In the social sphere, it enables students to analyze the major factors behind acidification or pollution of bodies of water. After presenting a detailed case study, it calls on the students to assess the value of articles discussing problems arising from the use of chemicals.

LAB ACTIVITIES

Physical Science Program: Secondary IV does not have any objectives of a strictly experimental nature. In this sense, it is not aimed at developing skills specific to lab work. The experiments found in the learning guides for the courses in this program help students visualize or test certain chemical or physical phenomena introduced in the course, which helps them understand those phenomena. Summative evaluation does not include any lab activities.

STUDENTS TARGETED

General admission into college requires that students pass the courses in this program, so they are intended primarily for all students who plan to pursue either general education or technical training at college. Since the credits for these courses may be counted as optional credits toward the Secondary School Diploma (SSD), they are also intended for students who plan to obtain the SSD.

PREREQUISITES

The three courses in *Physical Science Program: Secondary IV* are the first science courses in the adult curriculum. Since they are independent of one another, there are no science prerequisites for the courses in this program.

Adult students must, however, demonstrate sufficient proficiency in the language of instruction and in mathematics to learn the content of these courses. They must therefore have passed the English Language Arts and mathematics courses in Secondary III. Insufficient proficiency in the language of instruction or mathematics could raise the level of difficulty in courses and unduly prolong the learning time, giving students the false impression that sciences are difficult and inaccessible.

RELATIONSHIP WITH PREVIOUS PROGRAMS

Physical Science Program: Secondary IV replaces the old courses *Chemistry 241* (CHE-4009-3) and *Physics 254* (PHS-5021-3). Table 1 in the Appendix shows the relationship between the new program and the previous programs.

The transition from the old to the new program provide for the following situations:

- Students who have already passed the old course CHE-4009-3 must take PSC-4010-2 and PSC-4011-2.
- Students who have already passed the old course PHS-5021-3 must take PSC-4010-2 and PSC-4012-2.

These combinations, as well as others that include courses from older programs, meet the admission requirements for college studies, both as a general admission requirement for *Physical Science 416* and as a special requirement for *Physical Science 436*. Every year the Ministère de l'Éducation, du Loisir et du Sport du Québec (MELS) publishes a list of courses or combinations of courses that meet these requirements in the document entitled *Préalables pour l'admission à un programme conduisant à un diplôme d'études collégiales*. To access the current version of this document, go to the DSE Web site at <www.mels.gouv.qc.ca/sanction> and click on *Préalables au CEGEP* (or simply go to <www.mels.gouv.qc.ca/ens-sup>), then place the cursor on *Collégial* and click on the heading *Programmes d'études*.

EQUIVALENCES IN THE YOUTH SECTOR PROGRAM

Together, the three courses in *Physical Science Program: Secondary IV* constitute a recognized equivalent of the course *Physical Science 436* in the youth sector. A direct correlation can be established between each of the modules in the youth sector program and the corresponding course in the adult sector program (see Table 1 in the Appendix).

The course *Physical Science 416* in the youth sector has no equivalent in the adult sector. The courses in the adult sector have a similar learning time (150 hours) and include the 27 extra intermediate objectives that distinguish program 436 from program 416. Since practically all these objectives are found in Module 3, *Ionic Phenomena: A Study of an Environmental Problem*, students who have already successfully completed the youth sector *Physical Science 416* and wish to take a course equivalent to *Physical Science 436* must take PSC-4012-2 in the adult sector. Passing the courses PSC-4010-2 and PSC-4011-2 is not, however, equivalent to passing *Physical Science 416* in the youth sector.

NONCUMULATIVE COURSES

For students who plan to obtain the Secondary School Diploma (SSD) and already have some high school credits in sciences, it will be worthwhile to consult the following list of noncumulative courses.

Noncumulative courses—*Physical Science Program: Secondary IV*

Adult Sector		Youth Sector
Current Program	Previous Programs	
PSC-4010-2	PSC/SCP-4010-3	Current programs: 556-416, 556-436, 056-416, 056-436 Previous programs: 556-414, 556-434, 056-414, 056-434
PSC-4011-2	PSC/SCP-4011-3, PHS/PHY-5021-3, PHS/PHY-5024-3	
PSC-4012-2	PSC/SCP-4012-3, CHE/CHI-4009-3, CHE/CHI-4010-3, CHI-4011-3	

EVALUATION

A number of documents set out the MELS prescriptions for the summative evaluation of courses in *Physical Science Program: Secondary IV*. For each course there is a document entitled *Definition of the Domain for Summative Evaluation*, published by the DFGA, which explains the framework and content of summative examinations, while the *Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education*, published by the Direction de la sanction des études (DSE), outlines the procedure for administering these examinations (document 18-7708-03A for the 2003 edition). This guide is updated regularly. The latest version can be obtained from the DSE Web site at <www.mels.gouv.qc.ca/sanction>.

The printed version of the *Definition of the Domain for Summative Evaluation* for each course in *Physical Science Program: Secondary IV* was distributed to all educational institutions in 1998. Copies can be obtained from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Definitions of the Domain for Summative Evaluation—*Physical Science Program: Secondary IV*

Course	Date of Publication	Document Code
Definition of the Domain for Summative Evaluation <i>Physical Science Program: Secondary IV</i> PSC-4010-2 Nuclear Technology: A Matter of Energy	November 1998	38-8817-A
Definition of the Domain for Summative Evaluation <i>Physical Science Program: Secondary IV</i> PSC-4011-2 Electricity: What's the Connection?	November 1998	38-8818-A
Definition of the Domain for Summative Evaluation <i>Physical Science Program: Secondary IV</i> PSC-4012-2 Ionic Phenomena: A Study of an Environmental Problem	November 1998	38-8816-A

The MELS is responsible for developing summative examinations for the three courses in *Physical Science Program: Secondary IV*. The examinations developed by the MELS are in keeping with the framework set out in the *Definitions of the Domain for Summative Evaluation*. The use of these examinations, known as ministry examinations, is compulsory. No other examination is admissible for the purposes of summative evaluation. It should be noted, however, that the division of responsibilities between the MELS and educational institutions may be modified over the years. For this reason, the list of courses in the SAGE (*Sanction des études des adultes en formation générale*) system, which is updated annually, is the source of information to consult.

LEARNING MATERIALS

The Société de formation à distance des commissions scolaires du Québec (SOFAD) prepares and publishes learning materials for both distance education courses and courses given in classrooms at adult education centres. SOFAD provides a Learning Guide for each course in *Physical Science Program: Secondary IV* as well as individual Lab kits. For information on prices and how to obtain the materials, the SOFAD Web site can be accessed at <www.sofad.qc.ca>.

Chemistry Program: Secondary V

INTRODUCTION

Chemistry Program: Secondary V is a general education program for adult students enrolled in Secondary Cycle Two. It is intended for students who wish to pursue their studies in programs requiring rigorous scientific preparation in which the sciences occupy an important place.

Like the Physics program, which was developed according to the same model, the Chemistry program is designed to help students develop the scientific knowledge and skills they need to pass college-level science courses. In particular, it is aimed at introducing the scientific method to the students. For this reason, the development of experimental skills plays a dominant role in the objectives of this program.

In extending the orientations of *Physical Science Program: Secondary IV*, *Chemistry Program: Secondary V* aims to establish relationships between theoretical concepts and the historical context in which they were discovered and illustrates the many interrelationships between history, technology and society.

The printed version of *Chemistry Program: Secondary V* was distributed to all educational institutions in July 1999. Copies can be obtained from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Chemistry Program: Secondary V

Title	Date of Publication	Document Code
<i>Chemistry Program: Secondary V</i>	July 1999	38-8318-A

Chemistry Program: Secondary V was first published in French as *Chimie, 5^e secondaire* (38-8318).

PROGRAM STRUCTURE

Chemistry Program: Secondary V consists of three courses that must be taken in the order of presentation outlined below. Both the relationship between the content of the courses and the sequence for learning the skills associated with the experimental method justify this requirement. The first course is designed to familiarize the student with the experimental method. In the second course, the elements of the experimental method are developed more thoroughly while the aim of the third course is the integration of these elements.

Each course is a 50-hour course and counts for two Secondary V credits toward the Secondary School Diploma (SSD).

Courses in *Chemistry Program: Secondary V*

Code	Title	Hours	Credits
CHE-5041-2	Gases	50	2
CHE-5042-2	Chemical Reactions 1: Energy and Chemical Dynamics	50	2
CHE-5043-2	Chemical Reactions 2: Equilibrium and Oxidation-Reduction	50	2

COURSE DESCRIPTIONS

Below is a brief description of the content of each course.

CHE-5041-2 Gases

In this course, by learning about the scientific method, students will gain a better understanding of the behaviour of gases and will be able to establish links with related technical phenomena, social changes and environmental consequences.

This course covers:

- the properties of the states of matter and the general behaviour of substances undergoing phase changes
- the presence of gases in nature and their use by humans
- the laws governing the behaviour of gases
- the ideal gas law and Dalton's law of partial pressure
- the energy balance of a chemical reaction occurring in a gaseous state

CHE-5042-2 Chemical Reactions 1: Energy and Chemical Dynamics

In this course, by learning about the scientific method, students will gain a better understanding of chemical dynamics and energy transfers involved in chemical reactions and will be able to establish links with related technical phenomena, social changes and environmental consequences.

This course covers:

- energy transfers related to phase changes, mixtures of substances at different temperatures, solutions or chemical reactions
- the rate of chemical reactions and the factors on which it depends
- the collision theory and the relationship between energy, the rate of a chemical reaction and the factors on which such a rate depends

CHE-5043-2 Chemical Reactions 2: Equilibrium and Oxidation-Reduction

In this course, by learning about the scientific method, students will gain a better understanding of chemical equilibrium and oxidation-reduction and will be able to establish links with related technical phenomena, social changes and environmental consequences.

This course covers:

- qualitative and quantitative analysis of chemical equilibrium
- oxidation-reduction and the operation of electrochemical cells

LAB ACTIVITIES

Unlike *Physical Science Program: Secondary IV*, *Chemistry Program: Secondary V* and *Physics Program Secondary V* include experimental objectives. These two programs were designed specifically to enable students to learn the experimental method, which they need to know in order to pursue studies in fields in which science occupies an important place. These objectives are focuses of evaluation.

Even though this program has experimental objectives, no list of experiments is prescribed. It is up to the teacher to choose experiments. The authors of SOFAD's experimental activity guides (see the section on learning materials) have made specific choices and propose specific experiments, but teachers may very well replace them with other activities that cover the same learning content.

Experimental Objectives—*Chemistry Program: Secondary V*

Course	Experimental objectives
CHE-5041-2	6 objectives
CHE-5042-2	5 objectives
CHE-5043-2	9 objectives

STUDENTS TARGETED

The courses in *Chemistry Program: Secondary V* are intended mainly for students who plan to pursue their studies in a general education or technical training program at a college that requires this training as a special admission requirement. Since the credits for these courses may be counted as optional credits toward the Secondary School Diploma (SSD), they are also intended for students who plan to obtain the SSD.

PREREQUISITES

The three courses in *Physical Science Program: Secondary IV* in the adult sector or the course *Physical Science 436* in the youth sector or any of their equivalents are prerequisites for *Chemistry Program: Secondary V*. The most frequently used equivalents are either the combination of two old courses, *Chemistry 241* (CHE-4009-3) and *Physics 254* (PHS-5021-3), in the adult sector, or the combination of *Physical Science 416* in the youth sector with PSC-4012-2 in the adult sector. For the other possible equivalents, consult the latest version of *Préalables pour l'admission à un programme conduisant à un diplôme d'études collégiales*, published every year by the MELS. To access this document, go to the DSE Web site at <www.mels.gouv.qc.ca/sanction> and click on *Préalables au CEGEP* (or simply go to <www.mels.gouv.qc.ca/ens-sup>), then place the cursor on *Collégial* and click on the heading *Programmes d'études*.

Students must also demonstrate sufficient proficiency in the language of instruction and in mathematics to learn the content of these courses. They must therefore have passed English Language Arts and Mathematics courses in Secondary IV. Insufficient proficiency in the language of instruction or mathematics could raise the level of difficulty in courses and unduly prolong the learning time, giving students the false impression that sciences are difficult and inaccessible. In the case of mathematics, even though intermediate-level or enriched courses are usually required, together with chemistry courses, for admission into college-level programs of study, it is enough that students pass the courses in the regular Secondary IV program in order to enroll in courses in *Chemistry Program: Secondary V*.

RELATIONSHIP WITH PREVIOUS PROGRAMS

Chemistry Program: Secondary V replaces the old courses *Chemistry 252* (CHE-5024-3) and *Chemistry 253* (CHE-5025-3). Table 2 in the Appendix shows the relationship between the new program and the previous programs.

The transition from the old to the new program provide for a single situation:

- Students who have already passed the old course CHE-5024-3 must take CHE-5043-2.

However, in view of the sequence for acquiring skills associated with the experimental method outlined in the current program, it might be considered appropriate to provide students with remedial instruction in the skills covered in the first two courses. Such remediation is all the more important for any students who have not previously done lab work. The establishment of a local chemistry program can provide a framework for such remedial instruction by providing recognition of learning and the time required for learning.

This combination, as well as others that contain courses from older programs, meet the admission requirements for college studies as a special requirement for *Chemistry 534*. The abovementioned *Préalables pour l'admission à un programme conduisant à un diplôme d'études collégiales* provides a list of courses or combinations of courses that meet these requirements.

EQUIVALENCES IN THE YOUTH SECTOR PROGRAM

Together, the three courses in *Chemistry Program: Secondary V* constitute a recognized equivalent of the course *Chemistry 534* in the youth sector. A direct correlation can be established between each of the modules of the youth sector program and the corresponding course in the adult sector program (see Table 2 in the Appendix). The objectives of the course *The Tools and Methods of Science* (TMS 532) in the youth sector and several of the enrichment objectives of *Chemistry 534* are also distributed over the three Chemistry courses in the adult sector.

NONCUMULATIVE COURSES

For students who plan to obtain the Secondary School Diploma (SSD) and already have some high school credits in sciences, it will be worthwhile to consult the following list of noncumulative courses.

Noncumulative courses—*Chemistry Program: Secondary V*

Adult Sector		Youth Sector
Current Program	Previous Programs	
CHE-5041-2	None	Current programs: 551-584, 051-584
CHE-5042-2	CHE/CHI-5024-3, CHI-5027-3, CHE/CHI-5030-3	Previous programs: 551-534, 051-534
CHE-5043-2	CHE/CHI-5025-3, CHI-5028-3, CHE/CHI-5031-3	Current programs: 551-584, 051-584 , 556-532, 056-532 Previous programs: 551-534, 051-534

EVALUATION

A number of documents set out the MELS prescriptions for the summative evaluation of courses in *Chemistry Program: Secondary V*. For each course there is a document entitled *Definition of the Domain for Summative Evaluation*, published by the DFGA, which explains the framework and content for summative examinations, while the *Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education*, published by the DSE, outlines the procedure for administering these examinations (document 18-7708-03A for the 2003 edition). This guide is updated regularly. The latest version can be obtained from the DSE Web site at <www.mels.gouv.qc.ca/sanction>.

The printed version of the *Definition of the Domain for Summative Evaluation* for each course in *Chemistry Program: Secondary V* was distributed for the first time in 1999 to all educational institutions. In 2004, because the duration of examinations was modified, a new version was distributed. Copies can be obtained from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Definitions of the Domain for Summative Evaluation—*Chemistry Program: Secondary V*

Course	Date of Publication	Document Code
Definition of the Domain for Summative Evaluation <i>Chemistry Program: Secondary V</i> CHE-5041-2 Gases	November 1999 (out-of-date) January 2004	38-8791-A 41-9010-A
Definition of the Domain for Summative Evaluation <i>Chemistry Program: Secondary V</i> CHE-5042-2 Chemical Reactions 1: Energy and Chemical Dynamics	November 1999 (out-of-date) January 2004	38-8792-A 41-9011-A
Definition of the Domain for Summative Evaluation <i>Chemistry Program: Secondary V</i> CHE-5043-2 Chemical Reactions 2: Equilibrium and Oxidation-Reduction	November 1999 (out-of-date) January 2004	38-8793-A 41-9012-A

The development of summative examinations for courses in *Chemistry Program: Secondary V* is currently a local responsibility; in other words, the educational institution is responsible for producing examinations in accordance with the requirements established in the *Definitions of the Domain for Summative Evaluation*. To help school boards fulfill this responsibility, the Société de Gestion du réseau informatique des commissions scolaires (Société GRICS) has placed at their disposal a database of examinations for all courses in programs for which summative evaluation is a local responsibility (*Banque d'instruments de mesure en formation générale des adultes*, BIM-FGA). Most of the examinations in this database are developed by teachers of the school boards. The Société GRICS provides the supervision necessary for the development of examinations and handles their validation. The examinations in the BIM-FGA database comply with the requirements of the *Definitions of the Domain for Summative Evaluation*.

LEARNING MATERIALS

SOFAD prepares and publishes learning materials for both distance education courses and courses given in classrooms at adult education centres. SOFAD provides a Learning Guide for each course in *Chemistry Program: Secondary V*. It also offers a workbook containing the documents and worksheets required for lab activities. Individual Lab kits containing the materials required for the lab activities in each course can also be obtained from SOFAD. For information on prices and how to obtain the materials, the SOFAD Web site can be accessed at <www.sofad.qc.ca>.

Physics Program: Secondary V

INTRODUCTION

Physics Program: Secondary V is a general education program for adult students enrolled in Secondary Cycle Two. It is intended for students who wish to pursue their studies in programs requiring rigorous scientific preparation in which the sciences occupy an important place.

Like the Chemistry program, which was developed according to the same model, the Physics program is designed to help student develop the scientific knowledge and skills need to pass college-level science courses. In particular, it is aimed at introducing the scientific method to the students. For this reason, the development of experimental skills plays a dominant role in the objectives of this program.

In extending the orientations of *Physical Science Program: Secondary IV*, *Physics Program: Secondary V* helps establish relationships between theoretical concepts and the historical context in which they were discovered and illustrates the many interrelationships among history, technology and society.

The printed version of *Physics Program: Secondary V* was distributed to all educational institutions in February 2000. Copies can be obtained from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Physics Program: Secondary V

Title	Date of Publication	Document Code
<i>Physics Program: Secondary V</i>	February 2000	38-8313-A

Physics Program: Secondary V was first published in French as *Physique, 5^e secondaire* (38-8313).

PROGRAM STRUCTURE

Physics Program: Secondary V consists of three courses that must be taken in the order of presentation outlined below. Both the relationship between the content of courses and the sequence for acquiring the skills associated with the experimental method justify this requirement. The first course is designed to familiarize the student with the experimental method. In the second course, the elements of the experimental method are developed more thoroughly, while the aim of the third course is the integration of these elements.

Each course is a 50-hour course and counts for two Secondary V credits toward the Secondary School Diploma (SSD).

Courses in *Physics Program: Secondary V*

Code	Title	Hours	Credits
PHS-5041-2	Optics	50	2
PHS-5042-2	Kinematics and Momentum	50	2
PHS-5043-2	Forces and Energy	50	2

COURSE DESCRIPTIONS

Below is a brief description of the content of each course.

PHS-5041-2 Optics

In this course, by learning about the scientific method, students will gain a better understanding of optics and of technical phenomena and social changes associated with the development of optics.

This course covers:

- the propagation of light
- the behaviour of light reflected from plane and curved mirrors
- the behaviour of light refracted by lenses and other substances
- the electromagnetic spectrum and applications of its various ranges

PHS-5042-2 Kinematics and Momentum

In this course, by learning about the scientific method, students will gain a better understanding of kinematics and momentum and of technical phenomena and social changes associated with the development of mechanics.

This course covers:

- the perception of motion and the concept of trajectory
- analysis of the trajectories of different moving objects
- analysis of rectilinear motion and rectilinear motion with uniform acceleration
- analysis of the two-dimensional motion of a projectile
- applications of the principle of conservation of momentum

PHS-5043-2 Forces and Energy

In this course, by learning about the scientific method, students will gain a better understanding of dynamics and of technical phenomena, environmental consequences and social changes associated with the development of dynamics.

This course covers:

- the concept of force and the consequences of applying force to an object
- gravitational force and its characteristics
- the motion of an object as a function of work, energy and the conservation of energy
- friction between two surfaces and air resistance on objects in motion
- Archimede’s principle
- the extension of a spring and pressure
- the operation of simple and compound machines

LAB ACTIVITIES

Unlike *Physical Science Program: Secondary IV*, *Physics Program: Secondary V* and *Chemistry Program: Secondary V* include experimental objectives. These two programs were designed specifically to enable students to learn the experimental method, which they need to know in order to pursue studies in fields in which the sciences occupy an important place. These objectives are focuses of evaluation.

Even though the program has experimental objectives, no list of experiments is prescribed. It is up to the teacher to choose the experiments. The authors of SOFAD’s experimental activities guide (see the section on learning materials) have made specific choices and propose specific experiments, but teachers may very well replace them with other activities that cover the same learning content.

Experimental Objectives—*Physics Program: Secondary V*

Course	Experimental Objectives
PHS-5041-2	7 objectives
PHS-5042-2	3 objectives
PHS-5043-2	6 objectives

STUDENTS TARGETED

The courses in *Physics Program: Secondary V* are intended mainly for students who plan to pursue their studies in a general education or technical training program at a college that requires this training as a special admission requirement. Since the credits for these courses may be counted as optional credits toward the Secondary School Diploma (SSD), they are also intended for students who plan to obtain the SSD.

PREREQUISITES

The three courses in *Physical Science Program: Secondary IV* in the adult sector or the course *Physical Science 436* in the youth sector or any of their equivalents are prerequisites for *Physics Program: Secondary V*. The most frequently used equivalents are either the combination of the two old courses in the adult sector, *Chemistry 241* (CHE-4009-3) and *Physics 254* (PHS-5021-3), or the combination of *Physical Science 416* in the youth sector with PSC-4012-2 in the adult sector. For the other possible equivalents, consult the latest version of the document *Préalables pour l'admission à un programme conduisant à un diplôme d'études collégiales*, published every year by the MELS. To access this document, go to the DSE Web site at <www.mels.gouv.qc.ca/sanction> and click on *Préalables au CEGEP* or simply go to <www.mels.gouv.qc.ca/ens-sup>, then place the cursor on *Collégial* and click on the heading *Programmes d'études*.

Adult students must demonstrate sufficient proficiency in the language of instruction and in mathematics to learn the content of these courses. They must therefore have passed Secondary IV English Language Arts and Mathematics courses. Insufficient proficiency in the language of instruction or mathematics could raise the level of difficulty in courses and unduly prolong the learning time, giving students the false impression that sciences are difficult and inaccessible. In the case of mathematics, even though most of the time intermediate-level or enriched courses are required together with physics courses for admission into college-level programs, it is enough that students pass courses in the regular Secondary IV program in order to enroll in courses in *Physics Program: Secondary V*.

RELATIONSHIP WITH PREVIOUS PROGRAMS

Physics Program: Secondary V replaces the old courses *Physics 253* (PHS-5034-3), *Physics 251* (PHS-5018-3) and *Physics 252* (PHS-5019-3). Table 3 in the Appendix shows the relationship between the new program and the previous programs.

The transition from the old to the new program provide for the following situations:

- Students who have already passed the old course PHS-5034-3 must take PHS-5042-2 and PHS-5043-2.
- Students who have already passed the old course PHS-5018-3 must take PHS-5041-2 and PHS-5043-2.
- Students who have already passed the old courses PHS-5034-3 and PHS-5018-3 must take PHS-5043-2.

- Students who have already passed the old courses PHS-5018-3 and PHS-5019-3 must take PHS-5041-2.

However, in view of the sequence for acquiring the skills associated with the experimental method outlined in the current program, it might be considered appropriate to provide students with remedial instruction in the skills covered in the first or the first two courses. Such remediation is all the more important for any students who have not previously done lab work. The establishment of a local physics program can provide a framework for such remedial instruction by providing recognition of learning and the time required for learning.

These combinations, as well as others that include courses from older programs, meet the admission requirements for college studies as a special requirement for *Physics 534*. The abovementioned *Préalables pour l'admission à un programme conduisant à un diplôme d'études collégiales* provides a list of courses or combinations of courses that meet these requirements.

EQUIVALENCES IN THE YOUTH SECTOR PROGRAM

Together, the three courses in *Physics Program: Secondary V* constitute a recognized equivalent of the course *Physics 534* in the youth sector. A direct correlation can be established between the modules in the youth sector program and courses in the adult sector program (see Table 3 in the Appendix). The objectives of the youth sector course *The Tools and Methods of Science* (TMS 532) and several of the enrichment objectives of *Physics 534* can also be found among the three Physics courses in the adult sector.

NONCUMULATIVE COURSES

For students who plan to obtain the Secondary School Diploma (SSD) and already have some high school credits in sciences, it will be worthwhile to consult the following list of noncumulative courses.

Noncumulative courses—*Physics Program: Secondary V*

Adult Sector		Youth Sector
Current Program	Previous Programs	
PHS-5041-2	PHS/PHY-5034-3, PHS/PHY-4012-3, PHS/PHY-5020-3, PHS/PHY-5027-3	Current programs: 554-584, 054-584
PHS-5042-2	PHS/PHY-5018-3, PHS/PHY-5022-3, PHS/PHY-5025-3	Previous programs: 554-534, 054-534
PHS-5043-2	PHS/PHY-5019-3, PHS/PHY-5023-3, PHS/PHY-5026-3	Current programs: 554-584, 054-584 , 556-532, 056-532 Previous programs: 554-534, 054-534

EVALUATION

A number of documents set out the MELs prescriptions for the summative evaluation of courses in *Physics Program: Secondary V*. For each course there is a document entitled *Definition of the Domain for Summative Evaluation*, published by the DFGA, which explains the framework and content for summative examinations, while the *Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education*, published by the DSE, outlines the procedure for administering these examinations (document 18-7708-03A for the 2003 edition). This document is updated regularly. The latest version can be obtained from the DSE Web site at <www.mels.gouv.qc.ca/sanction>.

The printed version of the *Definition of the Domain for Summative Evaluation* for each course in *Physics Program: Secondary V* was distributed to all educational institutions for the first time in 2000. In 2004, when the duration of examinations was modified, a new version was distributed. Copies can be obtained from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Definitions of the Domain for Summative Evaluation—*Physics Program: Secondary V*

Course	Date of Publication	Document Code
Definition of the Domain for Summative Evaluation <i>Physics Program: Secondary V</i> PHS-5041-2 Optics	July 2000 (out-of-date) January 2004	38-3990-A 41-9013-A
Definition of the Domain for Summative Evaluation <i>Physics Program: Secondary V</i> PHS-5042-2 Kinematics and Momentum	July 2000 (out-of-date) January 2004	38-3988-A 41-9014-A
Definition of the Domain for Summative Evaluation <i>Physics Program: Secondary V</i> PHS-5043-2 Forces and Energy	July 2000 (out-of-date) January 2004	41-1036-A 41-9015-A

The development of summative examinations for courses in *Physics Program: Secondary V* is currently a local responsibility; in other words, each educational institution is responsible for producing examinations in accordance with the requirements set forth in the *Definition of the Domain for Summative Evaluation*. To help school boards fulfill this responsibility, the Société GRICS has placed at their disposal a database of examinations for all courses in the programs for which summative evaluation is a local responsibility (*Banque d'instruments de mesure en formation générale des adultes*–BIM-FGA). Most of the examinations in this database are developed by teachers at the school boards. The Société GRICS provides the supervision necessary for the development of examinations and handles their validation. The examinations in the BIM-FGA database comply with the requirements of the *Definitions of the Domain for Summative Evaluation*.

LEARNING MATERIALS

SOFAD prepares and publishes learning materials for both distance education courses and courses given in classrooms at adult education centres. SOFAD provides a Learning Guide for each course in *Physics Program: Secondary V*, as well as two workbooks containing the documents and worksheets required for lab activities. The first is a workbook for the course PHS-5041-2, while the second groups together the lab activities for two mechanics courses, PHS-5042-2 and PHS-5043-2. Individual Lab kits containing the materials required for these lab activities can also be obtained from SOFAD. For information on prices and how to obtain the materials, the SOFAD Web site can be accessed at <www.sofad.qc.ca>.

Biology: Secondary V

INTRODUCTION

The program *Biology: Secondary V* is a general education program for adult students enrolled in Secondary Cycle Two.

Published in 2004, this program is a revised version of the April 1987 version (document 38-0721, published in French only). A revision of this program was necessary in order to bring it into compliance with the requirements of the *Basic Adult General Education Regulation* (Régime pédagogique) regarding the pass mark and the number of hours equivalent to one credit.

The revised 1987 version led to a few changes in the program goals, which are as follows:

- to interest adults in human biology
- to encourage adults to maintain a healthy body, with a view to improving their health and lifestyle
- to help adults understand how humans influence the environment
- to help adults become familiar with the animal and plant kingdoms
- to show the interrelationships between humans, the animal kingdom and the plant kingdom

The printed version of *Biology: Secondary V* was distributed to all educational institutions in 2004. Copies can be obtained from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Biology: Secondary V

Title	Date of Publication	Document Code
<i>Biology: Secondary V</i>	March 2004	41-9000-A

The program *Biology: Secondary V* was first published in French as *Biologie, 5^e secondaire* (41-9000).

PROGRAM STRUCTURE

Biology: Secondary V consists of nine courses with a similar structure and approach that complement one another but have no hierarchical relationship. Depending on their choices and needs, students may take one or several courses, in any order.

Students who pass these courses earn Secondary V credits toward the Secondary School Diploma (SSD), two credits for each of the five 50-hour courses and one credit for each of the four 25-hour courses.

Courses in the Program *Biology: Secondary V*

Code	Title	Hours	Credits
BLG-5061-1	The Human Respiratory System	25	1
BLG-5062-2	The Human Reproductive System and the Perinatal Period	50	2
BLG-5063-2	The Human Digestive System	50	2
BLG-5064-2	The Anatomy and Physiology of Cells	50	2
BLG-5065-2	The Transmission of Hereditary Characteristics	50	2
BLG-5066-1	The Human Skeletal and Muscular System	25	1
BLG-5067-1	The Human Endocrine System	25	1
BLG-5068-2	The Human Nervous System	50	2
BLG-5069-1	Ecology	25	1

COURSE DESCRIPTIONS

Below is a brief description of the content of each course.

BLG-5061-1 The Human Respiratory System

By learning concepts of anatomy and physiology, adults will gain a better understanding of the human respiratory system and the health problems associated with it.

This course covers:

- anatomical structures of the respiratory system
- pulmonary inhalation and exhalation mechanisms
- gas exchanges in lungs and cells
- health problems related to the respiratory system

BLG-5062-2 The Human Reproductive System and the Perinatal Period

By learning concepts of anatomy and physiology, adults will gain a better understanding of the human reproductive system and the perinatal period, as well as the health problems associated with them.

This course covers:

- anatomical structures of the human male and female reproductive systems
- the onset of puberty in adolescent boys and girls
- the menstrual cycle and its relationship to female fertility
- physiological aspects of sexual relations

- stages of pregnancy and childbirth
- breast-feeding and bottle-feeding
- birth control methods
- abortion techniques
- sexually transmitted diseases

BLG-5063-2 The Human Digestive System

By learning concepts of anatomy and physiology, adults will gain a better understanding of the human digestive system and the health problems associated with it.

This course covers:

- the human digestive tract and digestive glands
- physical and chemical digestive processes
- human nutritional needs
- health problems related to the digestive system

BLG-5064-2 The Anatomy and Physiology of Cells

By learning concepts of anatomy and physiology, adults will gain a better understanding of the function of cells, the basic units of life.

This course covers:

- plant and animal cell structures
- cell nutrition and excretion
- cell reproduction
- cellular respiration
- deoxyribonucleic acid (DNA), ribonucleic acid (RNA)

BLG-5065-2 The Transmission of Hereditary Characteristics

By learning concepts of anatomy and physiology, adults will gain a better understanding of the transmission of human hereditary characteristics and the health problems associated with it.

This course covers:

- the transmission of hereditary characteristics
- problems associated with the transmission of hereditary characteristics

BLG-5066-1 The Human Skeletal and Muscular System

By learning concepts of anatomy and physiology, adults will gain a better understanding of the human skeletal and muscular system and the health problems associated with it.

The course covers:

- long bone structure, formation and growth
- structure and function of joints
- the human skeleton
- skeletal muscle structure and contraction
- movements performed by the muscle-bone complex and the benefits of muscular exercise
- health problems related to the skeletal and muscular system

BLG-5067-1 The Human Endocrine System

By learning concepts of anatomy and physiology, adults will gain a better understanding of the human endocrine system and the health problems associated with it.

The course covers:

- the secretion of hormones and their role in the human body
- disorders that can affect the endocrine glands

BLG-5068-2 The Human Nervous System

By learning concepts of anatomy and physiology, adults will gain a better understanding of the human nervous system and the health problems associated with it.

The course covers:

- the organization of the nervous system
- nerve cells
- the propagation of nerve impulses
- the central and peripheral nervous systems
- the reflex arc
- the regulatory function of the autonomic nervous system
- the effect of alcohol, drugs and heavy metals on the nervous system

BLG-5069-1 Ecology

By learning concepts of ecology, adults will gain a better understanding of the dynamics among the elements of an environment and the problems caused by environmental imbalance.

This course covers:

- photosynthesis
- the relationship among the elements in an ecosystem
- the structure of an ecosystem and its food web
- artificial eutrophication of a lake

LAB ACTIVITIES

As with the 1987 program, the current *Biology: Secondary V* program does not include lab activities.

STUDENTS TARGETED

Since the credits for the courses in this program may be counted as optional credits toward the Secondary School Diploma (SSD), they are intended for students who plan to obtain the SSD.

PREREQUISITES

No particular prerequisites are prescribed for enrollment in courses in *Biology: Secondary V*. However, adult students must demonstrate sufficient proficiency in the language of instruction to learn the content of these courses. Insufficient proficiency in the language of instruction could raise the level of difficulty in courses and unduly increase the learning time, giving students the false impression that sciences are difficult and inaccessible.

It should also be noted that each course requires a specialized vocabulary, which means that students must learn a large number of new terms.

RELATIONSHIP WITH THE PREVIOUS PROGRAM

A comparison of the current program with the 1987 version reveals that:

- Four themes have been eliminated: *The Human Environment*, *Organic Gardening*, *Tissues* (in English only) and *Les Poissons* (in French only).
- Two themes, *The Human Reproductive System* and *La périnatalité* (in French only), have been combined into one course.
- The remaining courses are now regrouped into eight single-theme courses.

Table 4 in the Appendix shows the relationships between the courses in *Biology: Secondary V* and those of the English version of the 1987 program. It should be noted that there are differences between the English and the French versions of this program.

EQUIVALENCES IN THE YOUTH SECTOR PROGRAM

Although some content elements of *Biology: Secondary V* match elements covered in the programs *Ecology 114*, *Biology 314* and *Biology 534*, no equivalence between the adult sector and the youth sector can be established.

NONCUMULATIVE COURSES

For students who plan to obtain the Secondary School Diploma (SSD) and already have some high school credits in sciences, it will be worthwhile to consult the following list of noncumulative courses.

Noncumulative courses—*Biology: Secondary V*

Adult Sector		Youth Sector
Current Program	Previous Programs	
BLG-5061-1	BLG/BIO-5021-1, BLG/BIO-5022-1	None
BLG-5062-2	BIO-4005-1, BIO-4006-1, BLG/BIO-5023-1, BLG/BIO-5024-1, BIO-5025-1, BIO-5049-1	None
BLG-5063-2	BLG/BIO-4007-1, BLG/BIO-4008-1, BLG/BIO-4009-1, BLG-4029-1, BLG-4030-1	None
BLG-5064-2	BLG/BIO-5026-1, BLG/BIO-5027-1, BLG/BIO-5028-1, BLG/BIO-5029-1, BLG/BIO-5030-1	None
BLG-5065-2	BLG/BIO-5035-1, BLG/BIO-5036-1, BLG/BIO-5037-1	None
BLG-5066-1	BLG/BIO-4023-1, BLG/BIO-4024-1	None
BLG-5067-1	BLG/BIO-5046-1	None
BLG-5068-2	BIO-5047-1, BIO-5048-1	None
BLG-5069-1	BIO 4028-1, BLG/BIO-4032-1, BLG/BIO-4033-1	None

EVALUATION

A number of documents set out the MELS prescriptions for the summative evaluation of courses in *Biology: Secondary V*. For each course there is a document entitled *Definition of the Domain for Summative Evaluation*, published by the DFGA, which explains the framework and content for summative examinations, while the *Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education*, published by the DSE, outlines the procedure for administering these examinations (document 18-7708-03A for the 2003 edition). This document is updated regularly. The latest version can be obtained from the DSE Web site at <www.mels.gouv.qc.ca/sanction>.

The printed version of the *Definition of the Domain for Summative Evaluation* for each course in *Biology: Secondary V* was distributed in 2004 to all educational institutions. Copies can be obtained from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Definitions of the Domain for Summative Evaluation—*Biology: Secondary V*

Course	Date of Publication	Document Code
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5061-1 The Human Respiratory System	March 2004	41-9001-A
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5062-2 The Human Reproductive System and the Perinatal Period	March 2004	41-9002-A
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5063-2 The Human Digestive System	March 2004	41-9003-A
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5064-2 The Anatomy and Physiology of Cells	March 2004	41-9004-A
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5065-2 The Transmission of Hereditary Characteristics	March 2004	41-9005-A
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5066-1 The Human Skeletal and Muscular System	March 2004	41-9006-A
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5067-1 The Human Endocrine System	March 2004	41-9007-A
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5068-2 The Human Nervous System	March 2004	41-9008-A
Definition of the Domain for Summative Evaluation <i>Biology: Secondary V</i> BLG-5069-1 Ecology	March 2004	41-9009-A

The development of summative examinations for courses in *Biology: Secondary V* is currently a local responsibility; in other words, each educational institution is responsible for producing examinations in accordance with the requirements established in the *Definitions of the Domain for Summative Evaluation*. To help the school boards fulfill this responsibility, the Société GRICS has placed at their disposal a database of examinations for all courses in programs of study for which summative evaluation is a local responsibility (*Banque d'instruments de mesure en formation générale des adultes*–BIM-FGA). Most of the examinations in this database are developed by teachers at the school boards. The Société GRICS provides the supervision necessary for developing examinations and handles their validation. The examinations in the BIM-FGA database comply with the requirements of the *Definitions of the Domain for Summative Evaluation*.

LEARNING MATERIALS

SOFAD prepares and publishes learning materials for both distance education courses and courses given in the classrooms of adult education centres. SOFAD is developing online courses for *Biology: Secondary V* and offers a printed version of the materials. For an updated list of the materials it produces as well as information on prices and how to obtain the materials, the SOFAD Web site can be accessed at <www.sofad.qc.ca>.

Part II: Pedagogical Information

Types of Course Objectives and Their Characteristics

PHYSICAL SCIENCE PROGRAM: SECONDARY IV

Each of the three courses in *Physical Science Program: Secondary IV* includes a series of general, terminal and intermediate objectives and related content. All objectives are presented in the form of learning objectives that are specifically intended for students.

General Objectives

The general objectives give an overall indication of the nature of the knowledge, the skills and attitudes to be acquired in a given course. They specify the overall program goals that correspond to a given course.

The program has 26 general objectives: 9 for the first course, 8 for the second and 9 for the third.

Terminal Objectives

The terminal objectives present the knowledge, skills and attitudes that the students should have acquired or developed by the end of the course. They are formulated to permit measurement and observation of the extent to which they have been attained.

The program has 71 terminal objectives: 21 for the first course, 26 for the second and 24 for the third. A decimal numbering system is used for these objectives, with the whole number (1, 2 or 3) indicating the course number and the decimal indicating the objective number. The numbering of the terminal objectives is designed to facilitate their location and is in no way intended to indicate sequence or relative importance. There is no relationship between the numbering of general objectives and the numbering of terminal objectives.

Unlike the Secondary V Chemistry and Physics programs, this program does not set forth a specific codification for the general or terminal objectives connected to any of the aspects of the STS approach, i.e. science, technology or society.

Intermediate Objectives and Content Elements

Each terminal objective is described by one or more intermediate objectives, which are themselves clarified by content elements. The intermediate objectives and the related content provide an indication of the scope of the terminal objectives. They specify or elaborate on the content of the terminal objectives. The list is not exhaustive, prescriptive or sequential. These objectives are not numbered.

CHEMISTRY PROGRAM: SECONDARY V AND PHYSICS PROGRAM: SECONDARY V

Chemistry Program: Secondary V and *Physics Program: Secondary V* have similar structures. Each course in the two programs is described by a general objective and a series of terminal and intermediate objectives. All objectives are presented in the form of learning objectives that are specifically intended for students.

General Objectives

The general objective is a statement of the intention of the course. It specifies the relationships to be established among the three categories of terminal objectives.

Terminal Objectives

Terminal objectives indicate the significance of the learning and the target to be attained through the intermediate objectives. They have been divided into three categories: related content, the experimental method and the *History–Technology–Society* (HTS) perspective. All of the terminal objectives are prescriptive.

Numbering of Terminal Objectives

Terminal objectives are numbered in a specific way in each category. The category of objectives with related content has a numerical notation that starts at 1 for each course. It indicates a logical sequence, but this sequence is not compulsory in the learning.

As a reminder of the continuity between the terminal objectives related to the experimental method, the objectives appear in alphanumerical order. Letters refer to the order of courses (A for the first course, B for the second and C for the third), while numbers refer to the different skills associated with the experimental method (e.g. writing a protocol, performing an experiment). Course objectives that are different but have matching numbers, such as A1, B1 and C1, generally deal with the same aspect of the experimental method.

Each course includes three terminal objectives associated with the HTS perspective. These three objectives have an alphabetical notation: the letter H refers to the historical dimension, the letter T refers to the technological dimension and the letter S to the social dimension.

Relationship Among Terminal Objectives Associated With the Experimental Method

There is a progression in the development of the skills associated with the experimental method. This progression was established not within a single course, but among the courses of a single program. Terminal objectives associated with the experimental method in the first course are designed to familiarize students with this method and its main elements (writing a protocol, performing an experiment and analyzing data). In the second course, they are designed to cover more thoroughly the

elements of the first course and include an objective aimed at familiarizing students with the requirement for writing a lab report. In the third course, the terminal objectives are designed to integrate all the skills associated with the experimental method.

The same terminal objectives associated with the experimental method and the same progression between these objectives are found in *Chemistry Program: Secondary V* and *Physics Program: Secondary V*. Table 5 in the Appendix shows the similarities between the objectives associated with the experimental method in the two programs.

Intermediate Objectives

Intermediate objectives specify the scope of both terminal objectives with related content and terminal objectives associated with the experimental method. Terminal objectives oriented to the HTS perspective do not have their own intermediate objectives. All intermediate objectives are prescriptive.

Intermediate Objectives With Related Content

A decimal numbering system is used for intermediate objectives with related content. The whole number refers to the number of the terminal objective to which they are connected and the decimal represents, in terms of content, a logical sequence that is not compulsory in the learning.

Some of these intermediate objectives are also related to a terminal objective associated with the experimental method or the HTS perspective. In such cases, the letters EX (experimental method), H (history), T (technology) or S (society) appear to the left of the objective number.

A table appearing at the end of each course summarizes the relationship between the terminal objectives associated with the experimental method and the intermediate objectives with related content. Another table shows the relationship between the terminal objectives focused on the HTS perspective and the intermediate objectives with related content.

A section called *Additional Information* is provided for some of the intermediate objectives with related content. This information is not prescriptive, limiting, or exhaustive. It is intended to assist prospective users of the program and includes details on content, limits, possible paths to explore, and so on.

Intermediate Objectives Associated With the Experimental Method

A list of intermediate objectives associated with the experimental method appears after the list of content-related intermediate objectives of each course. The numbering of the objectives associated with the experimental method also includes a decimal. The whole number reproduces the alphanumeric code (A1, B3, etc.) of the terminal objective to which the intermediate objective is connected. The decimal indicates, in terms of content, a logical sequence that is not compulsory for the learning.

Tables 6 and 7, presented in the Appendix, illustrate the hierarchy of the terminal and intermediate objectives associated with the experimental method, one for the *Chemistry Program: Secondary V* and the other for the *Physics Program: Secondary V*.

BIOLOGY: SECONDARY V

Each course in *Biology: Secondary V* is described by a general objective and a series of terminal and intermediate objectives. A table at the beginning of each course presents the general objective as well as a complete list of terminal objectives for this course. All objectives are presented in the form of learning objectives that are addressed directly to the student.

General Objectives

The general objective is a course's statement of the intention; it specifies the relationship to be established among the terminal objectives.

Terminal Objectives

Depending on the course, from four to nine terminal objectives indicate the significance of the learning and the expected outcome at the end of the course. For each course, the numbering of the terminal objectives begins at 1. All of the terminal objectives are prescriptive.

Intermediate Objectives

Intermediate objectives describe the scope of the terminal objectives more specifically and in greater detail. All of the intermediate objectives are prescriptive.

A decimal numbering system is used for the intermediate objectives. The whole number corresponds to the number of the terminal objective to which they are connected and the decimal indicates, in terms of content, a logical sequence that is not compulsory in the learning.

A section called *Additional Information* is provided for most of the intermediate objectives. This information is not prescriptive, limiting, or exhaustive. It is intended to assist prospective users of the program and includes details on content, limits, paths to explore, and so on.

STS Approach to *Physical Science Program: Secondary IV*

Physical Science Program: Secondary IV uses the *Science-Technology-Society* (STS) approach, which highlights the numerous relationships between science and human activity; it relates science to the students' lives, both as individuals and as a group. This approach attempts to make learning all the more meaningful and places scientific knowledge in a historical perspective. By doing so, the approach invalidates the myth of the absolute nature of scientific knowledge. Students come to realize that scientific concepts are not static and that their evolution is linked to the development of theoretical and technical knowledge.

The STS approach attempts to give students an analytical perspective on scientific and technological phenomena, which influence, or are influenced by, the evolution of society. The *Physical Science* program should therefore enable students to:

- understand that technology is an application of science
- understand that science, technology and society constantly interact and influence each other
- increase their ability to examine techno-scientific problems and to express opinions about them

HTS Perspective on *Chemistry Program: Secondary V* and *Physics Program: Secondary V*

As a follow up to the *Science-Technology-Society (STS)* approach from *Physical Science Program: Secondary IV*, *Chemistry Program: Secondary V* and *Physics Program: Secondary V* are designed to help students establish relationships between the theoretical concepts and the historical context in which they were discovered, understand the mutual impact that science and technology have had on each other over the years and continue to have, and think about the impact that scientific discoveries or technological applications have had and are continuing to have on human life and the environment. This is what the authors have called the *History-Technology-Society* perspective (HTS).

In the courses of *Physical Science Program: Secondary IV*, the STS orientation was retained as a framework for formulating objectives and the approach of choice for learning sciences. In the Chemistry and Physics programs, the objectives of the HTS perspective complement the other objectives, serving as a reminder that science never develops in a vacuum, and while it contributes to the development of society, its progress is affected by the political, social and technological realities of the time.

Each course presents three terminal objectives stated in a similar way:

- to illustrate, using historical examples, relationships between the course content and advances that have been made in chemistry or physics, as the case may be
- to illustrate, using examples, the role of the course content in technical applications
- to illustrate, using examples, environmental consequences and social changes resulting from these technological applications

As was explained in the chapter on the types of objectives and their characteristics, rather than having their own intermediate objectives, the above objectives are associated with the intermediate objectives with related content. In this way, they are not isolated as an area of study placed after the content objectives, but integrated with the learning as it progresses, thereby reflecting the interrelationships among science and history, technology and society.

The following tables present lists of the related content associated with the historical, technological and social perspectives of *Chemistry Program: Secondary V* and *Physics Program: Secondary V*.

Content Associated With the HTS Perspective—*Chemistry Program: Secondary V*

Historical Perspective

CHE-5041-2	CHE-5042-2	CHE-5043-2
<ul style="list-style-type: none">- temperature scales and absolute zero- Avogadro's work- discoveries resulting from the study of gases	<ul style="list-style-type: none">- Joule's work- discoveries resulting from the study of energy transfers and chemical dynamics	<ul style="list-style-type: none">- discoveries resulting from the study of chemical equilibrium and oxidation-reduction

Technological Perspective

CHE-5041-2	CHE-5042-2	CHE-5043-2
<ul style="list-style-type: none">- phase change- air and other gaseous substances- differences in pressure- density	<ul style="list-style-type: none">- energy conversions- use of fossil fuels- catalysts- technical applications of chemical dynamics	<ul style="list-style-type: none">- everyday acids and bases- chemical equilibrium in industrial applications- operation of electrochemical and electrolytic cells- applications of electrochemistry

Social Perspective

CHE-5041-2	CHE-5042-2	CHE-5043-2
<ul style="list-style-type: none">- emission of gaseous pollutants- health effects- technological use of gases	<ul style="list-style-type: none">- fossil fuels- incomplete combustion of hydrocarbons- introduction of chemicals into the environment	<ul style="list-style-type: none">- disturbance of the equilibrium of a natural cycle- importance of pH in certain environments- use of chemical equilibrium in industry- development of electrochemistry

Related Content Associated With the HTS Perspective—*Physics Program: Secondary V*

Historical Perspective

PHS-5041-2	PHS-5042-2	PHS-5043-2
<ul style="list-style-type: none"> - vision - optical instruments - nature of light 	<ul style="list-style-type: none"> - subjects covered by mechanics - measurement of the speed of light - discoveries in kinematics 	<ul style="list-style-type: none"> - gravitational force - knowledge about aerodynamics - technical evolution of machines

Technological Perspective

PHS-5041-2	PHS-5042-2	PHS-5043-2
<ul style="list-style-type: none"> - plane mirrors - Newtonian telescope - curve mirrors - total internal reflection - lenses - invisible waves 	<ul style="list-style-type: none"> - projectiles - conservation of momentum 	<ul style="list-style-type: none"> - absence of gravity - friction or air resistance - Archimedes' Principle - springs - hydraulic lift cylinder - mechanical transmission

Social Perspective

PHS-5041-2	PHS-5042-2	PHS-5043-2
<ul style="list-style-type: none"> - artificial light - curve mirrors - fibre optics - optical instruments 	<ul style="list-style-type: none"> - perception of the Universe - development of means of rapid transport 	<ul style="list-style-type: none"> - development of aerodynamics - development and application of dynamics

Skills Associated With the Experimental Method

Chemistry Program: Secondary V and Physics Program: Secondary V

As mentioned in the chapter on the types of objectives and their characteristics, *Chemistry Program: Secondary V* and *Physics Program: Secondary V* have the same terminal objectives associated with the experimental method and the same progression from each objective to the next.

A progression has been established between each course of a program in the development of skills associated with the experimental method:

- The first course is designed to help students become familiar with the experimental method and its key elements (writing a protocol, performing an experiment and analyzing data).
- The second course covers more thoroughly the elements introduced in the first course and includes an objective aimed at familiarizing the students with the requirement for writing a laboratory report.
- The third course is designed to integrate all the skills covered by the terminal objectives associated with the experimental method.

Tables 5, 6 and 7 in the Appendix show the similarities between the two programs and the progression in the development of the skills associated with the experimental method.

As with the HTS perspective, the development of skills associated with the experimental method is integrated with learning of related content and is therefore not a separate section. Some of the intermediate objectives of related content, designated by the abbreviation “EX,” are specifically designed for the development of these skills. Each of these objectives involves a lab activity. Depending on the step this activity belong to, the elements of the experimental method that are the focus of learning are different. A table appearing at the end of each course lists the objectives associated with the experimental method covered by each of the lab activities.

For each step (familiarization, in-depth study and integration) in each program, the following tables list the intermediate objectives with related content that correspond to the objectives associated with the experimental method.

Intermediate Objectives With an Experimental Content
Chemistry Program: Secondary V

CHE-5041-2 Step 1: Familiarization With the Experimental Method

1.1	To compare the observable properties of the solid, liquid and gaseous states of matter.
3.7	To deduce Boyle's law from a graphic analysis of experimental data.
4.1	To determine, through experimentation, the relationship between the volume and temperature of a gas kept at constant pressure.
5.1	To deduce the relationship between the number of moles of gas and the volume it occupies, on the basis of a graphic analysis of experimental data.
5.3	To determine, through experimentation, the nature of the gases produced by electrolysis, as well as the ratio between the volumes of gases obtained.
6.5	To determine the partial pressure exerted by each component of a gas mixture, on the basis of experimental results.

CHE-5042-2 Step 2: In-Depth Study of the Experimental Method

1.4	To classify physical and chemical phenomena according to whether they represent endothermic or exothermic reactions, on the basis of observations.
1.5	To determine, through experimentation, the factors that influence the final temperature of a mixture.
2.6	To determine, through experimentation, the molar heat of solution of a substance.
3.6	To inductively discover Hess's law through experiment.
4.3	To determine, through experimentation, the influence of the surface area, the nature of the reactants and their concentration on the rate of a reaction.

CHE-5043-2 Step 3: Integration of the Experimental Method

1.3	To verify, through experimentation, whether or not a system is in equilibrium.
1.6	To determine, through experimentation, how increasing the concentration of a reactant affects a system in equilibrium.
2.3	To establish, through experimentation, a mathematical relation to characterize the equilibrium of the ionization of an acid.
2.4	To determine, through experimentation, the relative strength of two or more acids.
2.10	To determine the pH of a solution using measurements obtained by titration.
3.1	To observe an oxidation-reduction reaction.
3.4	To list ions in order of their reducing power, on the basis of observations made during an experiment.
3.6	To measure the potential difference produced by different pairs of metals.
3.10	To construct an electrochemical cell.

Intermediate Objectives With an Experimental Content
Physics Program: Secondary V

PHS-5041-2 Step 1: Familiarization With the Experimental Method

1.6	To observe the phenomena of umbra and penumbra in relation to the size of a light source and the distances between the source, the object and the screen.
2.6	To determine experimentally the paths of light rays and the field of vision produced by a plane mirror.
3.4	To establish a qualitative relation, based on observations, between the location of an object and the characteristics of its image in a concave mirror.
4.3	To determine experimentally the index of refraction for a substance.
5.3	To compare the optical power of two or more lenses of the same type, but with different curvatures.
5.6	To determine experimentally the characteristics of an image formed by a converging lens, according to the location of the object.
6.1	To observe the dispersion of white light by a prism.

PHS-5042-2 Step 2: In-Depth Study of the Experimental Method

3.8	To determine experimentally the equations of motion for an object in uniform rectilinear motion.
4.7	To determine experimentally the equations of motion for an object in rectilinear motion with uniform acceleration.
6.3	To use inductive reasoning to derive the law of conservation of momentum from experimental data.

PHS-5043-2 Step 3: Integration of the Experimental Method

2.4	To determine experimentally the relationship between mass and gravitational force, using a spring scale (dynamometer).
3.4	To prove Newton's Second Law in an experiment.
5.2	To determine experimentally the factors affecting the friction between two surfaces.
6.2	To determine experimentally the factors affecting Archimedian buoyant force.
7.1	To determine experimentally the relationship between applied force and extension for a spring.
8.2	To use inductive reasoning to derive law of levers, based on an experiment.

Characteristics and Methods of Evaluation

In the *Policy on the Evaluation of Learning*,¹ the MELS defines evaluation as “the process whereby a judgment is made on a student’s learning on the basis of information gathered, analyzed and interpreted, for the purpose of making pedagogical and administrative decisions.” This definition highlights the two primary purposes of evaluation: support for learning, a function mainly associated with formative evaluation, and the recognition of learning, which forms the basis of summative evaluation.

FORMATIVE EVALUATION

In the course of learning, evaluation serves the purpose of providing support for learning because it aims primarily at fostering students’ progress. It allows for regulation of the learning and teaching processes. Thus, the teacher verifies to what extent the pedagogical intervention has produced the expected outcomes on student learning and makes adjustments if necessary. The teacher regularly informs students about their strengths and weaknesses and offers appropriate enrichment and support measures. The students use this feedback to gradually take charge of their learning.

Formative evaluation relies on the teacher’s professional judgment. It may be formal or informal. It relies on more or less structured tools, depending on the needs. Since it provides continuous feedback, it serves to regulate learning and support, and to guide decisions about the choice of learning situations, materials and pedagogical interventions.

By asking appropriate questions, teachers can verify whether students have the acquired knowledge that is prerequisite for new learning. By knowing the right vocabulary, observing students’ work habits and learning methods or providing suggestions on methodology, teachers can help students learn effectively. And by using technical reinforcements, analogies and other similar strategies, teachers can help their students better tackle new materials and develop new skills. This will give them incentive to overcome the obstacles they encounter and to see in these difficulties new challenges rather than further situations involving failure.

Other than the *Policy on the Evaluation of Learning*, the MELS has produced few written materials on the subject of formative evaluation. The DFGA has produced and distributed a few complementary examinations but none for the science programs.

1. *Policy on the Evaluation of Learning*, Ministère de l’Éducation du Québec, 2003 (document 13-4602A), available at the following Web site: <www.mels.gouv.qc.ca/dfga>.

SUMMATIVE EVALUATION

The purpose of summative evaluation is to recognize learning. It takes place at the end of a learning or training sequence. It is designed to establish the level of mastery of the knowledge, skills and behaviours that were the focus of learning during this period. This type of evaluation is done with reference to the program requirements. It entails verifying the extent to which students meet these requirements.

A number of MELS documents provide information on summative evaluation. For each course there is a document entitled *Definition of the Domain for Summative Evaluation*, which describes the content and form of the examinations, and the *Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education*, which outlines the procedure for administering examinations and the certification of learning achievement.

DEFINITION OF THE DOMAIN FOR SUMMATIVE EVALUATION

For the purposes of summative evaluation, the DFGA prepares and publishes a *Definition of the Domain for Summative Evaluation* for each course in a program of study. These documents are the framework for developing summative examinations. The content of the *Definitions of the Domain for Summative Evaluation* is prescriptive, which ensures that the summative examinations are valid from one version to the next, from one year to the next, or from one educational institution to the next when the examinations are a local responsibility.

More particularly, the *Definitions of the Domain for Summative Evaluation* describe several facets of summative evaluation. They describe the orientations of the program and their consequences for summative evaluation, they contain the list of concepts to be evaluated; the list and definitions of skills that were retained, the weighting of different elements, the statement of observable behaviours to be measured, explanations for the choices made, details on the examination and, if applicable, examples of documents (data tables, formulas, symbols, etc.) to be provided to the students for the examination.

For each course in *Physical Science Program: Secondary IV*, *Chemistry Program: Secondary V*, *Physics Program: Secondary V* and *Biology: Secondary V*, a *Definition of the Domain for Summative Evaluation* was distributed to all school boards at the time of publication. These documents can also be accessed from the DFGA Web site at <www.mels.gouv.qc.ca/dfga>.

Table 9 in the Appendix presents in a single list all the *Definitions of the Domain for Summative Evaluation* provided for each program as they appear in Part I of this guide.

RESPONSIBILITY FOR DEVELOPING EXAMINATIONS

Summative evaluation can be either the responsibility of the MELS or a local responsibility. Table 10 in the Appendix sets forth the division of responsibilities in developing summative examinations as of 2005. The division of responsibilities for the adult sector is harmonized with the current division of responsibilities in the youth sector. Note that it may be modified over the years. The list of course codes in the SAGE system and the *Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education*, updated annually, contain the most current information on this subject.

In cases where the MELS is responsible for developing examinations, it issues to educational institutions what are known as “ministry examinations.” These examinations must be used in their original form and they must be administered and corrected in accordance with MELS requirements.

In cases where the development of examinations is a local responsibility, the educational institution is responsible for producing the examinations to be used for summative evaluation. In this instance, the examinations must comply with all the requirements set out in the *Definition of the Domain for Summative Evaluation*. The MELS may, however, propose complementary examinations, which educational institutions may or may not choose to use. The MELS has not published any complementary examinations for courses in the science programs covered by this guide.

To help educational institutions assume their responsibility in developing summative examinations, the Société GRICS has placed at their disposal a database of examinations for all courses in programs of study for which summative evaluation is a local responsibility (*Banque d'instruments de mesure en formation générale des adultes*—BIM-FGA). The examinations in this database were developed by teachers. The Société GRICS provides the supervision needed to develop examinations and handles their validation. A committee of evaluation specialists supervises all the steps in the process. An updated list of examinations offered by the Société GRICS can be accessed from its Web site at <www.grics.qc.ca>.

ADMINISTRATIVE MANUAL FOR THE CERTIFICATION OF STUDIES IN GENERAL EDUCATION FOR ADULTS AND IN VOCATIONAL EDUCATION

The *Administrative Manual for the Certification of Studies in General Education for Adults and in Vocational Education*, prepared by the DSE, contains the information required for applying rules for the evaluation and certification of studies set forth in the *Education Act* and in special school regulations applicable to services in general education for adults and in vocational training. It supplements the annual directives and its updates become official as soon as they are published.

This manual is distributed to the people responsible for certification of studies in adult general education and in vocational training and to the directors of adult education centres. It can also be accessed from the MELS Web site at <www.mels.gouv.qc.ca/sanction>.

A brief overview of the table of contents of this voluminous document gives an idea of its scope. It contains eight chapters and two appendixes dealing with the following topics:

- Legal Provisions
- Certification Requirements
- Student Record Management
- Recognition of Scholastic Learning
- Recognition of Experiential Learning
- Evaluation of Scholastic Learning
- Support Measures and Exemptions
- Official Certification Documents
- List of Course Codes (in Appendix 1)
- Forms (in Appendix 2)

Chapter 6, which deals with the evaluation of scholastic learning, contains information on:

- Basic principles of evaluation for certification of studies
- Division of responsibilities between the MELS and educational institutions
- Preparation of examinations
- Administration of examinations
- Marking examinations, recording, safeguarding and transmitting examination results
- Administration of supplementary examinations

LOCAL POLICY ON THE EVALUATION OF LEARNING

In addition to the rules imposed by the MELS, educational institutions may establish additional rules in the jurisdictions placed under their responsibility. Many school boards have established a policy on the evaluation of learning for the institutions in their purview in this way. Those who wish to learn more about the requirements of the local evaluation policy may contact the director of their centre or the person responsible for evaluation of adult general education at their school board.

Specifications Concerning Summative Evaluation

PHYSICAL SCIENCE PROGRAM: SECONDARY IV

As specified in the *Definition of the Domain for Summative Evaluation* for each course, the orientations of *Physical Science Program: Secondary IV* have repercussions not only on the nature of the activities used for evaluation but also on the subjects of this evaluation. Students are therefore evaluated not only on related scientific content, but also on the objectives of the STS approach (social, economic and political issues associated with scientific and technical development).

Skills Evaluated

For courses in *Physical Science Program: Secondary IV*, four skills were retained for the purposes of summative evaluation. They are defined as follows:

- **Knowing:** stating the manifestations or components of a scientific or technical phenomenon
- **Understanding:** applying acquired knowledge to deduce information
- **Analyzing:** examining the components of a phenomenon in order to determine relationships
- **Synthesizing:** integrating, in a relevant and organized manner, different skills and themes with a view to defining or solving a problem or making a decision

Type of Examination

For each course in *Physical Science Program: Secondary IV*, the examination for summative evaluation is divided into two parts, which take place in two separate sessions. Both are held at the end of the course, except for Part I of the PSC-4010-2 examination, which is on the research project carried out during the course. The pass mark is set at 60 out of 100 for the total of the two parts of the examination. The use of a calculator is permitted.

The following table summarizes the characteristics of summative examinations for courses in *Physical Science Program: Secondary IV*.

Characteristics of Examinations—*Physical Science Program: Secondary IV*

Examination	Characteristics of the examination	Documents provided to the student for the examination	Duration	Value
PSC-4010-2 Part I	Research project carried out during the course		N/A	25%
PSC-4010-2 Part II	Written examination at the end of the course Objective and short-answer items	Periodic table without the names of the elements Calculator permitted	120 min	75%
PSC-4011-2 Part I	Written examination at the end of the course Objective and short-answer items	List of formulas Calculator permitted	120 min	78%
PSC-4011-2 Part I	Written examination at the end of the course Extended-response items		90 min	22%
PSC-4012-2 Part I	Written examination at the end of the course Objective and short-answer items	Periodic table showing elements with electronegativity values List of names, formulas and charges of some polyatomic ions Calculator permitted	120 min	76%
PSC-4012-2 Part II	Written examination at the end of the course Extended-response items		90 min	24%

CHEMISTRY PROGRAM: SECONDARY V AND PHYSICS PROGRAM: SECONDARY V

The orientations of *Chemistry Program: Secondary V* and *Physics Program: Secondary V* affect the types of evaluation activities and the objects of this evaluation. These programs place a great deal of emphasis on the experimental method and, because they use terminal and intermediate objectives of an experimental nature, they require that the students perform lab experiments. The examinations therefore deal not only with related scientific content, but also with the objectives designed to develop skills associated with the experimental method and the HTS perspective. The *Definition of the Domain for Summative Evaluation* for each course describes the content of the evaluation in detail.

Skills Evaluated

For courses in *Chemistry Program: Secondary V* and *Physics Program: Secondary V*, three skills were retained for the purposes of summative evaluation. They are defined as follows:

- **Knowing:** describing or recognizing manifestations or components of a scientific or technical phenomenon
- **Understanding:** applying acquired knowledge to deduce information
- **Analyzing:** examining the components of a phenomenon in order to determine relationships

Type of Examination

For each course in the two programs, the examination for summative evaluation is divided into two parts, which take place in two separate sessions. Both parts of the examination are compulsory. All the observable behaviours for each dimension must be taken into account.

The pass mark is set at 60 out of 100 for the total of the two parts of the examination.

The following two tables summarize the characteristics of summative examinations for courses in the Chemistry and Physics programs.

Characteristics of the Examinations—*Chemistry Program: Secondary V*

Examination	Characteristics of the examination	Documents provided to the student for the examination	Duration	Value
CHE-5041-2 Part I	Written examination at the end of the course Restricted-response, short-answer or extended-response items	Periodic table List of formulas Characteristics of certain gases Information specified in Dimensions 3 and 4 Calculator permitted	180 min	80%
CHE-5041-2 Part II	Written examination at the end of the course Short-answer and extended-response items	Calculator permitted	90 min	20%
CHE-5042-2 Part I	Written examination at the end of the course Restricted-response, short-answer or extended-response items	Periodic table List of formulas Information specified in Dimensions 2 and 3 Calculator permitted	180 min	75%
CHE-5042-2 Part II	Laboratory examination at the end of the course Extended-response items Requires access to a lab	Lab materials	90 min	25%
CHE-5043-2 Part I	Written examination at the end of the course Restricted-response, short-answer or extended-response items	Periodic table Table of standard reduction potentials Information specified in Dimension 4 Calculator permitted	180 min	70%
CHE-5043-2 Part II	Laboratory examination written at the end of the course Extended-response items Requires access to a lab	Lab materials Calculator permitted	120 min	30%

Characteristics of Examinations—*Physics Program: Secondary V*

Examination	Characteristics of the examination	Documents provided to the student for the examination	Duration	Value
PHS-5041-2 Part I	Written examination at the end of the course Restricted-response, short-answer or extended-response items	List of formulas Information specified in Dimensions 2 and 4 Calculator permitted	180 min	85%
PHS-5041-2 Part II	Laboratory examination at the end of the course Short-answer and extended-response items Requires access to a lab	Lab materials Calculator permitted	90 min	15%
PHYI-5042-2 Part I	Written examination at the end of the course Restricted-response, short-answer or extended-response items	List of formulas Information specified in Dimension 3 Calculator permitted	180 min	70%
PHYI-5042-2 Part II	Written examination at the end of the course Short-answer and extended-response items	Calculator permitted	90 min	30%
PHS-5043-2 Part I	Written examination at the end of the course Restricted-response, short-answer or extended-response items	List of formulas Information specified in Dimensions 2 and 3 Calculator permitted	180 min	70%
PHS-5043-2 Part II	Laboratory examination at the end of the course Short-answer and extended-response items Requires access to a lab	Lab materials Calculator permitted	120 min	30%

BIOLOGY: SECONDARY V

The goal of *Biology: Secondary V* is to help students acquire knowledge of the anatomy and physiology of the human body and to help them understand the functioning of the human body and the causes and effects of the most common health problems. Accordingly, summative evaluation is oriented mainly to the acquisition of this knowledge, to an understanding of how the human body works and to the student's ability to establish relationships between the knowledge acquired and the most common health problems.

Unlike *Chemistry Program: Secondary V* and *Physics Program: Secondary V*, *Biology: Secondary V* does not have an experimental section and was not designed with an HTS perspective. The evaluation as a whole is therefore concerned with proficiency in the related content.

Skills Evaluated

For courses in *Biology: Secondary V*, three skills were retained for the purposes of summative evaluation. They are defined as follows:

- Describing: observing, identifying or recalling the characteristics of a phenomenon or the components of a system
- Explaining: showing in a structured way the nature and interaction of complex relationships between objects or phenomena
- Analyzing: examining the components, the relationships between components and the laws or mechanisms of a system or complex set of components

Type of Examination

The summative evaluation of each course in the program *Biology Secondary V* is based on a written examination, which takes place at the end of the course. The pass mark is set at 60 out of 100.

The following table summarizes the characteristics of summative examinations for courses in *Biology: Secondary V*.

Characteristics of Examinations—*Biology: Secondary V*

Examination	Characteristics of the examination	Documents provided to the student for the examination	Duration	Value
BLG-5061-1	Written examination at the end of the course Structured-response and short-answer items	None	120 min	100%
BLG-5062-2				
BLG-5063-2				
BLG-5064-2				
BLG-5065-2				
BLG-5066-1				
BLG-5067-1				
BLG-5068-2				
BLG-5069-1				

Learning Materials

The MELS has not been responsible for producing learning guides for programs of study for adult students in Québec since 1995. This is a responsibility of the school boards or the publishing houses.

To date, publishing houses have produced very few learning materials for science courses. SOFAD has produced materials for students taking courses through distance education services and at educational institutions. An up-to-date list of the materials produced can be found at the SOFAD Web site at <www.sofad.qc.ca>.

Because scientific knowledge is now changing at a dizzying pace, some content, especially content associated with the STS approach or the HTS perspective, may be affected as new discoveries are made or new events occur. From this standpoint, it is exciting that students have access to less static sources of information than the traditional printed documents, which often take a long time to be updated. In this respect, the Internet offers a wealth of possibilities. In continuing adult education, the MELS' Direction des ressources didactiques (DRD) supports the Provincial Service RÉCIT (Réseau de personnes-ressources pour le développement des compétences des élèves par l'intégration des technologies). This service, which has its own regional extensions through its satellite sites (SitSats), produces a variety of documents and tools for teachers and students. The RÉCIT Provincial Service for Continuing Adult Education can be found at the RÉCIT Web site at <www.recit-edumatic.qc.ca>. The 12 regional Adult Education SitSats, including an English one, can also be accessed from this site or directly at <www.recit-edumatic.qc.ca/english>. The English Schools Network Récit Web site <www.qesnrecit.qc.ca> provides information and teaching material for the youth sector.

Labs and Lab Materials

Chemistry Program: Secondary V has 20 intermediate experimental objectives while *Physics Program: Secondary V* has 16. These objectives make it imperative to use work areas that comply with the standards for designing chemistry and physics labs that have the materials and equipment required for experiments.

With regard to lab activities, it is important to bear in mind that the MELS is not responsible for determining lab activities, only for setting experimental learning objectives. It is up to teachers and, by extension, the authors of learning guides to choose lab activities that will enable students to learn the content related to those objectives. It is those choices that will determine specific needs in terms of lab materials and specialized equipment.

However, there is no question that if adult education centres want to offer their students chemistry and physics courses in Secondary V, they must be provided with the necessary labs or work areas. That is why, during the 2001-2002 school year, the MELS granted financial assistance to the school boards for the purpose of setting up labs in adult education centres (Measure 30860).

Physical Science Program: Secondary IV does not include objectives aimed specifically at developing the skills associated with the experimental method. It proposes experiments to visualize or test certain phenomena that require products normally found in the home. It would be advantageous if the materials and equipment provided for students taking courses in this program were integrated with the facilities provided for Secondary V courses.

As mentioned in the first part of this document, it bears repeating that the courses in *Biology: Secondary V* do not require lab activities.

The purpose of the following sections is to present a few useful suggestions about the physical design of labs or work areas and the materials required for experiments.

PHYSICAL DESIGN

Labs or work areas must be designed to accommodate acid-resistant work surfaces, one or more sinks, electrical outlets, first-aid equipment (body shower, eyewash station, etc.), ventilated or unventilated enclosures and, if necessary, a fume hood and basins to recover toxic substances. It would also be worthwhile to set up one or more microcomputers with Internet access in the work areas.

The extent of reorganization required (surface area, equipment, etc.) is based on the number of enrollments in the Chemistry and Physics courses. Generally, there is no need to design labs to accommodate large groups of students at the same time and for the same experiment, as in the youth sector. Adult education centres generally require small labs with two to six workstations. However, in determining surface areas, administrators would be well advised to take into account

the needs of Secondary IV students, who could also benefit from spaces reorganized in this way to perform the experiments proposed in the Physical Science courses.

MATERIALS REQUIRED FOR LAB ACTIVITIES

The equipment and materials required for lab activities is divided into two categories: permanent equipment and materials, and perishable materials. The category of permanent equipment and materials includes beakers, petri dishes, flasks, burners, scales, light beam generators and other instruments that do not need to be restocked on a regular basis. Perishable materials are mostly basic products used almost exclusively in chemistry experiments (salts, acids, chemical compounds, etc.).

A list of materials required may be drawn up using lab activity manuals prepared by SOFAD. However, teachers may replace the experiments with other, similar experiments and therefore require different materials.

It must also be ensured that the materials required for the experimental part of the summative examinations are available at the right time for students enrolled in courses at institutions as well as in distance education courses.

In centres with only a very small number of enrollments, the use of material kits for distance education students may be considered as a short-term solution. The materials must then be supplemented and enriched in order to provide students with learning conditions that duplicate, as closely as possible, those found in a real lab.

Harmonization With Youth Sector Programs

It is important to clarify the concerns about harmonizing adult sector programs with youth sector programs. These concerns are based on a desire to make the exit profiles of young and adult students as similar as possible.

However, the reality of adults' school attendance is different from that of youth. Young students are required to follow the same school calendar and educational path, which extends from September to June over several consecutive years, while adults may study according to a timetable and calendar that differ from one student to another; and they may leave and come back over periods that can last several years. Programs of study addressed to adults must therefore allow individual students to progress and at the same time permit the review and recognition of prior learning.

The concept of harmonization should therefore not be understood to mean a perfect resemblance between the programs of the two sectors. Since students are required to successfully complete these programs in order to pursue advanced studies, the work of harmonizing programs focuses more on harmonizing related content and the associated competencies, such as the experimental method.

A comparative study was conducted to determine how youth sector programs correspond to adult sector programs. Based on a description of each intermediate objective in the youth sector programs, the related content specific to each program in this sector was identified, then the related content was located in the adult sector programs.

Almost all the related content identified in the youth sector programs is found in the adult sector programs. Some elements, however, especially enrichment objectives, were not retained. As well, two types of additions were made to the Secondary IV Physical Science and Secondary V Chemistry and Physics programs:

- knowledge associated with some enrichment objectives of the youth sector programs, which becomes compulsory in the adult sector program
- objectives associated with the themes introduced in the course or associated with the HTS approach

A comparative study of the youth and adult sector programs has led to the following findings:

Despite differences in their structures, instructional approaches, phrasing of objectives and approach to certain related content, the knowledge components of the Secondary IV and V programs in the adult sector have been harmonized with the knowledge components of the programs *Physical Science 436*, *Chemistry 534* and *Physics 534* in the youth sector.

The science programs of both sectors help to ensure that all students, youth and adults alike, are given similar scientific training that complies with the requirements for obtaining the Secondary School Diploma (SSD) and with college admission requirements, even if the programs in the two sectors are not carbon copies of each other.

The following sections provide brief comparisons of courses in the youth sector programs with courses in the adult sector programs.

SECONDARY IV PHYSICAL SCIENCE PROGRAMS

An equivalence can be established between the content of courses in the adult sector program and the modules in the youth sector program. Table 1 in the Appendix provides a good illustration of this equivalence. The courses *Nuclear Technology: A Matter of Energy* (PSC-4010-2) is equivalent to Module 1 (*Properties and Structure of Matter*) in the youth sector. The course *Electricity: What's the Connection?* (PSC-4011-2) corresponds to Module 2 (*Electrical Phenomena*). The course *Ionic Phenomena: A Study of an Environmental Problem* (PSC-4012-2) matches Module 3 (*Ionic Phenomena*).

A thorough comparison of the terminal and intermediate objectives of the two programs shows that their related content corresponds closely to each other. Only 4 of the 30 objectives found in program 436, including 3 objectives related to the construction of a measuring instrument, do not have counterparts in the adult sector program.

An overview of the additions made to the adult sector program reveals the importance attached to the technological aspects of the various uses of nuclear technology, to the study of residential circuits, to the examination of the choices to be made in electricity production, and to the examination of problems associated with the use of chemicals.

More specifically, the analysis of the terminal objectives of the youth sector program helps to establish the following equivalences:

PSC-4010-2/Module 1 of *Physical Science 416-436*

The knowledge components of 21 of the 27 intermediate objectives in Module 1 of the common core of basic subjects of the program *Physical Science 416-436* are found in the adult sector program. All the knowledge components of the objectives found in program 436 are covered and 6 of the 8 enrichment objectives also have counterparts in the course of the adult sector program.

Concepts in the youth sector program that were not retained in the adult sector program

- characteristic and noncharacteristic properties
- rules for developing an experimental procedure (dimension developed in Secondary V in the adult sector)
- relationship between the use of consumer goods and the properties of the substances used to make them
- catalysts, inhibitors, technological means (enrichment content)
- insulators, lubricants, protective substances (enrichment content)

Additions to the course PSC-4010-2 in the adult sector program

- types of nuclear reactions: radioactivity, fission, fusion
- nature, speed, electric charge and penetrating power of alpha, beta and gamma radiation and of X-rays, and how they affect matter
- relationship between the half-life of a radioactive element and the amount of a given sample of that element which remains after a certain period of time
- nuclear equation for the decay of a radioactive element
- units of measure for radiation
- relationships between the energy released during a nuclear reaction, the mass defect and the stability of the resulting isotope
- the atomic bomb and the hydrogen bomb
- nuclear reactors in Canada (CANDU), England, the United States and the former Soviet Union
- use of radioactive elements in medicine, food irradiation and carbon 14 dating
- advantages, disadvantages and difficulties involved in using nuclear fission and nuclear fusion to produce electricity
- risks, consequences and advantages of using nuclear energy

PSC-4011-2/Module 2 of *Physical Science 416-436*

The knowledge components of 24 of the 33 intermediate objectives of Module 2 of the common core of basic subjects in the program *Physical Science 416-436* are found in the adult sector program. The knowledge components of 6 of the 10 objectives found in program 436 as well as 7 of the 13 enrichment objectives have counterparts in the adult sector program.

Concepts in the youth sector program that were not retained in the adult sector program

- equivalences between the units of measure (enrichment)
- methods for presenting experimental results (developed in Secondary V)
- ferromagnetic substances, remanence, natural and artificial magnetic substances
- electromagnets, role of the core, effect of the nature of the core
- theory of magnetism, magnetization by induction, magnetization by particle alignment, mechanical effects on magnetism, Curie temperature (enrichment)
- factors that affect the magnetic field of an electromagnet: number of turns, current intensity, type of core
- mathematical relationships among the parameters that affect magnetic force (M_p , N , I) (enrichment)
- physical significance of the rate of change on a graph, constant of proportionality, conductance, unit of measure for conductance

- features of a measuring instrument, concept of error (developed in Secondary V)
- procedure to calculate the equivalent resistance of series circuits, parallel circuits and mixed circuits, numerical applications of Ohm's law and of the laws regarding voltage and electric currents (program 436: in the adult sector program, the study of mixed circuits is summarized in a qualitative analysis)
- ability to calculate heat energy ($Q = mc\Delta T$: introduced in Secondary V in the adult sector program)
- procedure for calculating electric and heat energy (introduced in Secondary V in the adult sector program)
- application of the law of conservation of energy
- energy transformation techniques
- concept of the dissipation of energy
- Québec's accomplishments in the field of hydroelectric production

Additions to the course PSC-4011-2 in the adult sector program

- characteristics of different kinds of cells, batteries and power supplies and the ways in which they are used
- distinguishing between alternating and direct current on the basis of their characteristics, sources and uses
- the use of certain wiring and distribution methods in residential electric circuits
- risks and dangers associated with the use of electricity
- relationship between science, technology and society in the history of electricity, magnetism and electromagnetism
- electrification of matter by rubbing, by contact and by induction
- applications of electromagnetism and the operating principles of a motor and a generator
- uses of static electricity and the dangers associated with it
- complexity of choosing a mode of electricity production

PSC-4012-2/Module 3 of *Physical Science 416-436*

The knowledge components of 18 of the 25 intermediate objectives in Module 3 of the common core of basic subjects in *Physical Science 416-436* are found in the adult sector program. All the knowledge components of the objectives in program 436 as well as 6 of the 10 enrichment objectives have counterparts in the adult sector program.

Concepts in the youth sector program that were not retained in the adult sector program

- acidic and basic salts, explanation of the behaviour and use of these salts
- method of measuring pH
- impact of the discovery of the law of conservation of matter, modification of scientific theories in light of scientific discoveries
- substances produced in Québec, their social, economic and environmental effects
- history of Québec's chemical industry
- consequences of recycling consumer products
- waste recovery and elimination techniques

Additions to the course PSC-4012-2 in the adult sector program

- case study (analysis of a problem related to the use of chemicals, its consequences and the proposed solutions)
- evaluation of newspaper or magazine articles about problems related to the use of chemicals

SECONDARY V CHEMISTRY PROGRAMS

Virtually all the content of courses in the adult sector program can be shown to have equivalents in the modules of the youth sector program. Table 2 in the Appendix provides an effective illustration of this equivalence. The course *Gases* (CHE-5041-2) is equivalent to Module 2 (*Gases and Their Applications*) of the youth sector program. The course *Chemical Reactions 1: Energy and Chemical Dynamics* (CHE-5042-2) corresponds to Modules 3 (*Energy in Chemical Reactions*) and 4 (*Rates of Chemical Reactions*). The course *Chemical Reactions 2: Equilibrium and Oxidation-Reduction* (CHE-5043-2) corresponds to Module 5 (*Equilibria in Chemical Reactions*). Lastly, the three Chemistry courses integrate almost all the objectives of the course *The Tools and Methods of Science* as well as elements from Module 1 (Research).

Very few elements of the youth sector programs were not retained in the adult sector program. A summary analysis of the courses presented in this section lists them. The adult sector program includes several elements that were added to the youth sector program. These additions are explained partly by the need to ensure that certain prerequisite elements are acquired and partly by the program authors' decision to devote special attention to history, technology and society.

Module 1: Research

In the adult sector, the Chemistry program does not contain specific objectives for documentary or experimental research, as it does in the youth sector. However, almost all the knowledge components associated with this research (methodology of choice, writing a protocol or a research plan, research methods, rules for writing a lab report) are covered in the objectives associated with the experimental method.

Methods and techniques for presenting an exhibit at a science fair and techniques for supporting arguments in public, proposed as enrichment content in the youth sector, are ill-suited to the andragogical and organizational context of adult education. These elements were not kept in the programs of this sector.

CHE-5041-2/Module 2 of *Chemistry 534*

Almost all the knowledge components of Module 2, *Gases and Their Applications* in the youth sector program were kept in the adult sector program. Of the compulsory elements of the program, only Boltzmann's constant (k) does not appear in the adult sector program. The knowledge components of Enrichment Objective 2.8 (Dalton's Law of Partial Pressure and using a barometer) are included in the adult sector program.

Additions to the course CHE-5041-2 in the adult sector program

- definition of temperature, standard temperature and pressure conditions, melting point and boiling point
- origin and role of gases present in nature
- study of the phenomenon of pressure
- historical section: progress made in chemistry thanks to the work of Avogadro, associating discoveries resulting from the study of gases to advances made in pure and applied chemistry
- technical applications in which gases or phase changes are used
- states of matter other than the solid, liquid or gaseous states

CHE-5042-2/Modules 3 and 4 of *Chemistry 534*

The bulk of the knowledge components in Module 3, *Energy in Chemical Reactions*, of the youth sector program were kept in the adult sector program. Of the compulsory elements of the program, only the topics of Québec's role in the research and development of the energy involved in a chemical reaction and human use of chemical energy for recreational purposes were not specifically retained in the adult sector program (Intermediate Objectives 4.4 and 4.6). However, since the terminal objectives associated with the HTS perspective use a frame of reference that extends beyond Québec's borders, it can encompass these topics as well. Enrichment Objective 4.5 (occupations associated with the development of knowledge of energy) was not reproduced in the adult sector program.

Similarly, almost all the knowledge components of Module 4, *Rates of Chemical Reactions*, were reproduced in the adult sector program, with the exception of Enrichment Objectives 3.4 and 3.5 (Institut de recherche sur les combustibles du Québec, combustible products in Québec, social and economic consequences and occupations associated with the development of knowledge of chemical energy).

Additions to the course CHE-5042-2 in the adult sector program

Review of prerequisite concepts:

- formation of chemical bonds as an introduction to the study of heat of reaction (formation of bonds and energy stability)

Concrete issues or applications:

- energy transfers produced during phase changes of a pure substance
- oxidation reactions (synthesis) in their environment
- combustion equation for several hydrocarbons
- associating the relative abundance of natural substances with their ability to react spontaneously
- applications of solutions in everyday activities
- technical applications of chemical dynamics

Historical section:

- Joule's establishment of a relationship between heat and mechanical energy
- associating discoveries resulting from the study of chemical dynamics to progress made in pure or applied chemistry
- problem-solving techniques
- problems with collision theory and the relationships between energy, reaction rate and the factors on which such a rate depends

CHE-5043-2–*Chemical Reactions 2: Equilibrium and Oxidation-Reduction*/Module 5 of *Chemistry 534: Equilibria in Chemical Reactions*

All the knowledge components of the module *Equilibria in Chemical Reactions* in the youth sector program were kept in the adult sector program, with the exception of Enrichment Objectives 4.4 and 4.5 (Institut de recherche sur les produits chimiques au Québec, social and economic consequences and occupations associated with the development of knowledge of chemical equilibrium).

Additions to the course CHE-5043-2 in the adult sector program

- curves illustrating forward and reverse reaction over time
- the effect of adding a catalyst on the equilibrium of a reaction
- solving qualitative problems related to the state of equilibrium of a system
- equilibrium constant and Le Châtelier's principle
- use of chemical equilibrium in an industrial application
- explanation for the eventual weakening of an electrochemical cell

SECONDARY V PHYSICS PROGRAMS

The courses of the adult sector program can be shown to correspond directly to the modules of the youth sector program. Table 3 in the Appendix provides a good illustration of this equivalence.

The course *Optics* (PHS-5041-2) is equivalent to Module 1 (*The Nature of Light*) of the youth sector program. The course *Kinematics and Momentum* (PHS-5042-2) and *Forces and Energy* (PHS-5043-2) correspond to the content of Module 3. Finally, the three Physics courses integrate virtually all the objectives of the course *The Tools and Methods of Science 532*.

Very few elements in the youth sector programs were not kept. A summary analysis of the courses presented in this section lists them. However, several elements were added to the adult sector program that are not present in the youth sector program. These additions are explained partly by the need to ensure that students learn certain prerequisite elements and partly by the program authors' decision to give particular attention to history, technology and society.

The knowledge components of three modules in the youth sector program were allocated to three courses in the adult sector program. However, the module *Optical Devices* has no direct counterpart in the adult sector program, but the learning objectives associated with it can be discerned through the development of skills associated with the experimental method.

PHS-5041-2/Module 1 of *Physics 534*

Other than the topic of Québec's participation (Intermediate Objective 6.3) in the development of optics and a few enrichment objectives, all the knowledge components of Module 1, *The Nature of Light*, were reproduced in the adult sector program.

Additions to the course PHS-5041-2 in the adult sector program

- the production of light and transformation of other forms of energy
- problems related to propagation of light
- description of the laser and some of its applications
- electromagnetic spectrum: the relative position of different wave groups and their technological applications, energy-frequency or energy-wavelength relations
- dual nature of light
- problems related to the electromagnetic spectrum and applications associated with its various regions

Module 2 of *Physics 534*

In the adult sector, the Physics program does not contain specific objectives for documentary or experimental research, as it does in the youth sector. However, almost all the knowledge components associated with this research (methodology of choice, writing a protocol or a research plan, research methods, rules for writing a lab report) are covered in the objectives associated with the experimental method. Only the more specialized knowledge components of the Physics program (laser measuring systems and the qualities of a good laser measuring system) are not specifically retained. In the objectives associated with the experimental method, the topics of measurement and the qualities of a good measuring system are addressed, but the study is not necessarily limited to optical measuring instruments.

PHS-5042-2 and PHS-5043-2/Module 3 of *Physics 534*

Almost all the knowledge components of Module 3, *Mechanics*, of the youth sector program are found in the adult sector program. Only the topics of mechanical power (definition and units of measure), rate of energy transfer (Intermediate Objective 5.5) and thermal energy released in a mechanical transformation (Intermediate Objective 6.5) were not kept. The other elements that were not kept are associated with enrichment objectives.

Additions to the courses PHS-5042-2 and PHS-5043-2 in the adult sector program

- trajectory and the perception of motion
- association of the discoveries about the motion of heavenly bodies with the evolution of human perception of the universe
- problem-solving techniques
- study of uniform rectilinear motion: in the youth sector, this topic is approached only from the perspective of a particular case of rectilinear motion with uniform acceleration, a movement where acceleration is zero
- comparative study of uniform rectilinear motion and rectilinear motion with uniform acceleration
- movement of a projectile: in the youth sector, this topic is touched on solely as enrichment content. The adult sector program also addresses applications of projectiles.
- the law of conservation of momentum: in the youth sector, this topic is broached solely as enrichment content. The adult sector program also discusses the applications of the law of conservation of momentum.
- the concept of force and the consequences of applying force: current direction of research on basic forces
- gravitational force: in the youth sector, gravitational force is approached as a component of rectilinear motion with uniform acceleration of a vertical motion and in the calculation of the weight of an object (distinction between the concepts of mass and weight).

Appendix

Table 1: Relationship between the current Physical Science program in the youth sector and the previous and current programs in the adult sector

Adult Sector Previous programs	Youth Sector <i>Physical Science 416-436</i>	Adult Sector Current program
CHE-4009-3 Chemistry 241 (GCH-241)	⇐ Module 1 Properties and Structure of Matter 50 hours ⇒	PSC-4010-2 Nuclear Technology: A Matter of Energy 50 hours
PHS-5021-3 Physics 254 (GPY-254)	⇐ Module 2 Electrical Phenomena 60 hours ⇒	PSC-4011-2 Electricity: What's the Connection? 50 hours
CHE-4009-3 Chemistry 241 (GCH-241)	⇐ Module 3 Ionic Phenomena 40 hours ⇒	PSC-4012-2 Ionic Phenomena: A Study of an Environmental Problem 50 hours

Notes

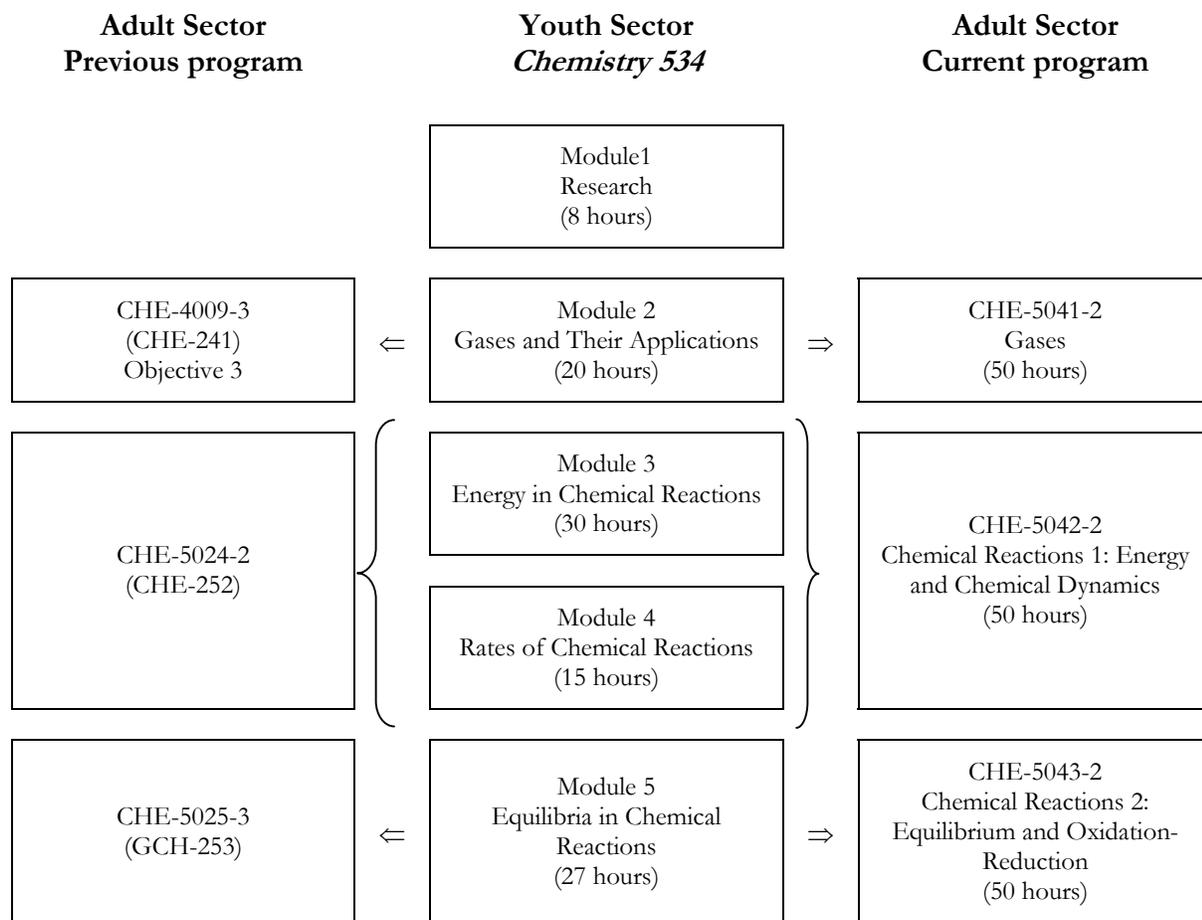
To make the transition from the old to the new program in the adult sector in the following situations:

- Students who have completed CHE-4009-3 must take PSC-4010-2 and PSC-4011-2, since they have already acquired the necessary knowledge of chemistry.
- Students who have completed PHS-5021-3 must take PSC-4010-2 and PSC-4012-2, since they have already learned the concepts in electricity.

The difference between the courses *Physical Science 416* and *Physical Science 436* in the youth sector is that 27 intermediate objectives were added to *Physical Science 436*, almost all of them in Module 3 of the program. Students who have already passed *Physical Science 416* in the youth sector and wish to obtain an equivalence for *Physical Science 436* in the adult sector must take PSC-4012-2.

The combination of the courses PSC-4010-2 and PSC-4011-2 does not constitute an equivalence for *Physical Science 416*. This combination, which yields only 4 credits, does not include any of the chemistry content found in Module 3 of the *Physical Science 416* program. Those who wish to find out how to obtain an equivalence in the adult sector for *Physical Science 416* in the youth sector may consult the document *Préalables pour l'admission à un programme conduisant à un diplôme d'études collégiales*, published every year by the MELS.

Table 2: Relationship between the current Chemistry program in the youth sector and the previous and current programs in the adult sector

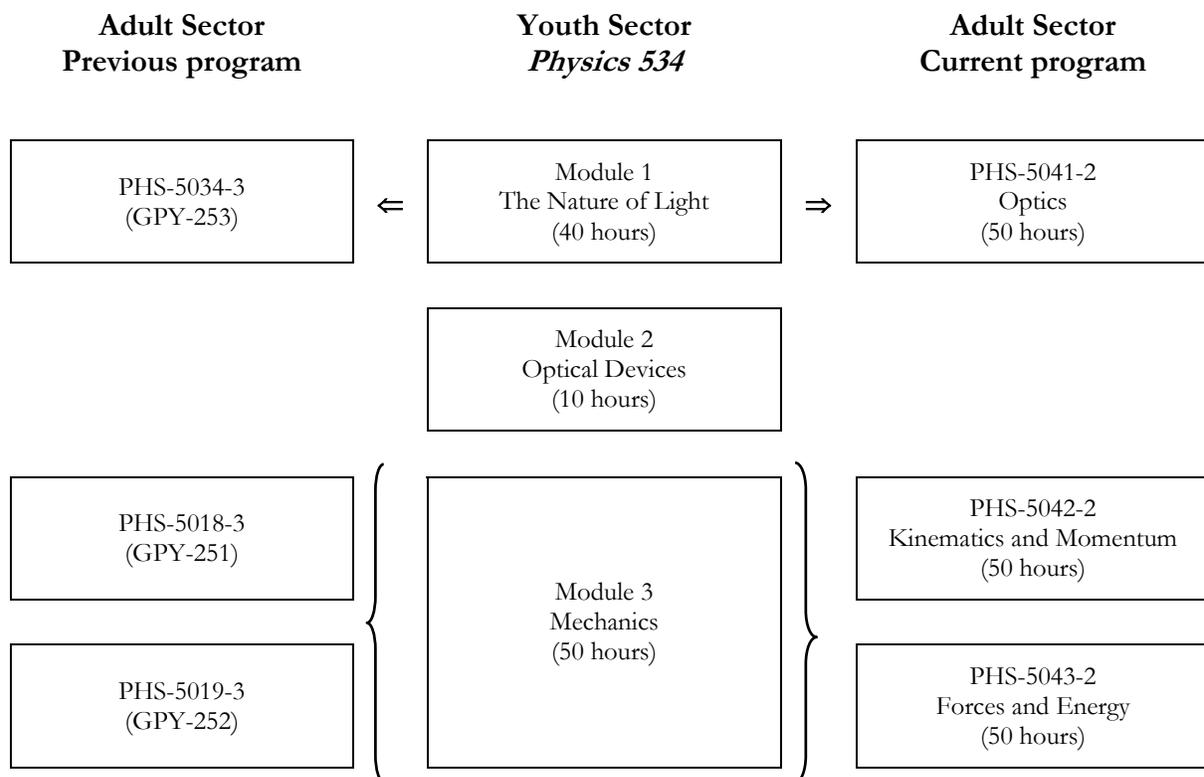


Notes

The Chemistry courses in the adult sector also cover the objectives of the course *The Tools and Methods of Science* (TMS 532, 50 hours) of the youth sector.

Only the combination of courses CHE-5024-3 and CHE-5025-3 in the old adult sector program is recognized as an equivalent of *Chemistry 534* in the youth sector. The atomic model of quantum mechanics introduced in the course *Chemistry 251* (CHE-5023-3) is no longer part of the Chemistry program in either the youth or adult sector and may not be considered in the establishment of an equivalence.

Table 3: Relationship between the current Physics program in the youth sector and the previous and current programs in the adult sector



Notes

The Physics courses in the adult sector also cover the objectives of the course *The Tools and Methods of Science* (TMS 532, 50 hours) of the youth sector.

Over the years, the course *Optics* GPY-253 (PHS-5034-3) has also had the name GPY-243 (PHS-4012-3) and the codes PHS-5020-3 and PHS-5027-3.

Table 4: Relationship between the courses in *Biology: Secondary V* and the courses in the 1987 program

2004 Program	1987 Program	
BLG-5061-1 The Human Respiratory System	GBA-251 (BLG-5021-1) GBA-252 (BLG-5022-1)	The study of resuscitation techniques was removed.
BLG-5062-2 The Human Reproductive System and the Perinatal Period	GBC-141 (BIO-4005-1)* GBC-142 (BIO-4006-1)* GBD-251 (BLG-5023-1) GBD-252 (BLG-5024-1) GBD-153 (BIO-5025-1)*	Some objectives were reformulated to include updates (abortion techniques, birth control methods and sexually transmitted diseases).
BLG-5063-2 The Human Digestive System	GBE-241 (BLG-4007-1) GBE-242 (BLG-4008-1) GBE-243 (BLG-4009-1)**	Biochemistry of carbohydrates, lipids and proteins, the study of different diets as well as the terminal objective on food additives were removed.
BLG-5064-2 The Anatomy and Physiology of Cells	GBF-251 (BLG-5026-1) GBF-252 (BLG-5027-1) GBF-253 (BLG-5028-1) GBF-254 (BLG-5029-1)** GBF-255 (BLG-5030-1)**	The study of cellular respiration is presented in a less biochemical way.
BLG-5065-2 The Transmission of Hereditary Characteristics	GBH-251 (BLG-5035-1) GBH-252 (BLG-5036-1) GBH-253 (BLG-5037-1)	The intermediate objectives dealing with meiosis were removed and the number of intermediate objectives dealing with hereditary characteristics associated with blood types and mutations was reduced. The order of terminal objectives was also changed.
BLG-5066-1 The Human Skeletal and Muscular System	GBJ-241 (BLG-4023-1) GBJ-242 (BLG-4024-1)	The objective dealing with muscular contraction was reorganized.
BLG-5067-1 The Human Endocrine System	GBL-251 (BLG-5046-1)	Two additions were made: a terminal objective concerning the endocrine system as a whole and the hormones associated with the reproductive system.
BLG-5068-2 The Human Nervous System	GBM-151 (BIO-5047-1)* GBM-152 (BIO-5048-1)*	The content proposed in the old course GBM-151 was subdivided into seven terminal objectives, but no content was added.
BLG-5069-1 Ecology	GBB-241 (BLG-4032-1) GBB-242 (BLG-4033-1)	A few intermediate objectives dealing with the eutrophication of a lake were taken from the old course GBK-143 (BLG-4027-1)* and added.

* In French only

** In English only

Table 5: Relationship among terminal objectives associated with the experimental method used in *Chemistry Program: Secondary V* and *Physics Program: Secondary V*

Course 1 CHE-5041-2 and PHS-5041-2 Familiarization (A)	Course 2 CHE-5042-2 and PHS-5042-2 In-Depth Study (B)	Course 3 CHE-5043-2 and PHS-5043-2 Integration (C)
A1 To become familiar with the scientific method.	B1 To apply the experimental method in simple cases.	C1 To apply the experimental method.
A2 To become familiar with writing an experimental procedure.	B2 To write up a simple experimental procedure.	C2 To write up an experimental procedure.
A3 To become familiar with carrying out an experiment.	B3 To carry out a simple experiment.	C3 To carry out an experiment.
A4 To become familiar with scientific analysis of experimental data.	B4 To analyze experimental data.	
	B5 To become familiar with the writing of a laboratory report.	C4 To write a laboratory report.

Table 6: Progression of the degree of complexity of the terminal objectives and intermediate objectives associated with the experimental method in *Chemistry Program: Secondary V*

CHE-5041-2 Familiarization (A)	CHE-5042-2 In-Depth Study (B)	CHE-5043-2 Integration (C)
<p>A1 To become familiar with the scientific method.</p> <p>A1.1 To learn about the experimental method by observing phenomena.</p> <p>A1.2 To use experimentation to establish a simple relationship between two parameters.</p>	<p>B1 To apply the experimental method in simple cases.</p> <p>B1.1 To use experimentation as a means of exploration.</p> <p>B1.2 To use experimentation to discover a law by inductive reasoning.</p>	<p>C1 To apply the experimental method.</p> <p>C1.1 To use experimentation as a means of verification.</p> <p>C1.2 To use experimentation for research purposes.</p>
<p>A2 To become familiar with writing an experimental procedure.</p> <p>A2.1 To distinguish between the object of the experiment and the parameters measured.</p> <p>A2.2 To understand the need to explore one relationship at a time.</p> <p>A2.3 To identify the constant parameters, the independent variable and the dependent variable.</p>	<p>B2 To write up a simple experimental procedure.</p> <p>B2.1 To establish the steps in a procedure.</p> <p>B2.2 To determine the independent variable, the dependent variable and the constant parameters.</p> <p>B2.3 To become familiar with writing of procedures.</p>	<p>C2 To write up an experimental procedure.</p> <p>C2.1 To choose the equipment necessary for an experiment.</p> <p>C2.2 To write up the procedure clearly.</p> <p>C2.3 To determine the applicable safety measures.</p>
<p>A3 To become familiar with carrying out an experiment.</p> <p>A3.1 To follow a simple experimental procedure.</p> <p>A3.2 To observe a phenomenon in an experiment.</p> <p>A3.3 To handle equipment in a simple experiment.</p> <p>A3.4 To become familiar with measurement and experimental uncertainty.</p> <p>A3.5 To apply the appropriate safety rules.</p>	<p>B3 To carry out a simple experiment.</p> <p>B3.1 To develop skill in handling experiment equipment.</p> <p>B3.2 To gather experimental data taking into account experimental uncertainty in writing the numerical data.</p> <p>B3.3 To apply the appropriate safety rules.</p>	<p>C3 To carry out an experiment.</p> <p>C3.1 To follow their own written experimental procedure.</p> <p>C3.2 To handle the experiment correctly.</p> <p>C3.3 To take measurements correctly, taking experimental uncertainty into account.</p> <p>C3.4 To apply the appropriate safety measures.</p>
<p>A4 To become familiar with the scientific analysis of experimental data.</p> <p>A4.1 To present experimental data in a double-entry table or in a graph.</p> <p>A4.2 To process experimental data.</p> <p>A4.3 To become familiar with the use of significant figures.</p> <p>A4.4 To distinguish between experimental error and uncertainty.</p> <p>A4.5 To interpret a graph.</p> <p>A4.6 To deduce a mathematical relationship from experimental data.</p>	<p>B4 To analyze experimental data.</p> <p>B4.1 To identify the causes of experimental errors.</p> <p>B4.2 To take significant figures into account when processing data.</p> <p>B4.3 To interpret experimental data with precision.</p>	
	<p>B5 To become familiar with the writing of a laboratory report.</p> <p>B5.1 To be familiar with the role of a laboratory report.</p> <p>B5.2 To become familiar with the parts of a laboratory report.</p> <p>B5.3 To discuss an experiment and write a conclusion.</p>	<p>C4 To write a laboratory report.</p> <p>C4.1 To be familiar with the structure of a laboratory report.</p> <p>C4.2 To describe the experiment performed: goals, equipment, steps, diagram.</p> <p>C4.3 To present the results of the experiment.</p> <p>C4.4 To present a rigorous analysis of the results.</p> <p>C4.5 To discuss the results.</p> <p>C4.6 To write the conclusions to the experiment clearly, relating them to the problem stated.</p> <p>C4.7 To clearly and logically present all the parts of a report.</p>

Table 7: Progression of the degree of complexity of terminal and intermediate objectives associated with the experimental method in *Physics Program: Secondary V*

<p style="text-align: center;">PHS-5041-2 Familiarization (A)</p>	<p style="text-align: center;">PHS-5042-2 In-Depth Study (B)</p>	<p style="text-align: center;">PHS-5043-2 Integration (C)</p>
<p>A1 To become familiar with the scientific method. A1.1 To use experimentation as a means of exploration. A1.2 To use experimentation to establish a simple relationship between two parameters.</p>	<p>B1 To apply the experimental method in simple cases. B1.1 To use experimentation to establish a mathematical relationship between parameters. B1.2 To use experimentation to discover a law by inductive reasoning.</p>	<p>C1 To apply the experimental method. C1.1 To use experimentation to establish a relationship between two parameters. C1.2 To use experimentation as a means of verification. C1.3 To use experimentation as a means of exploration.</p>
<p>A2 To become familiar with the technique for writing up an experimental procedure. A2.1 To understand the need to explore one relationship at a time. A2.2 To identify the constant parameters, the independent variable and the dependent variable.</p>	<p>B2 To write up a simple experimental procedure. B2.1 To distinguish the object of the experiment from the parameters measured. B2.2 To determine the independent variable, the dependent variable and the constant parameters. B2.3 To become familiar with writing of procedures.</p>	<p>C2 To write up an experimental procedure. C2.1 To choose the equipment necessary for an experiment. C2.2 To determine the stages of the work. C2.3 To write up the procedure clearly.</p>
<p>A3 To become familiar with the technique for carrying out an experiment. A3.1 To follow a simple experimental procedure. A3.2 To observe a phenomenon in an experiment. A3.3 To handle equipment in a simple experiment. A3.4 To become familiar with measurement.</p>	<p>B3 To carry out a simple experiment. B3.1 To develop the skill of handling experimental equipment. B3.2 To gather experimental data taking into account experimental uncertainty in writing the numerical data.</p>	<p>C3 To carry out an experiment. C3.1 To follow their own written experimental procedure. C3.2 To handle the equipment correctly. C3.3 To take the appropriate measures taking experimental error into account.</p>
<p>A4 To become familiar with the scientific analysis of experimental data. A4.1 To present experimental data in a double-entry table. A4.2 To process experimental data. A4.3 To deduce a simple relationship from experimental data.</p>	<p>B4 To analyze experimental data. B4.1 To present experimental data in the form of a graph. B4.2 To distinguish between experimental error and experimental uncertainty. B4.3 To identify the causes of experimental errors. B4.4 To take significant digits into account when processing data. B4.5 To interpret graphs and all experimental data rigorously.</p>	
	<p>B5 To become familiar with the writing of a laboratory report. B5.1 To be familiar with the role of a laboratory report. B5.2 To be familiar with the parts of a laboratory report. B5.3 To discuss an experiment and write a conclusion.</p>	<p>C4 To write a laboratory report. C4.1 To be familiar with the structure of a laboratory report. C4.2 To describe the experiment performed: goals, equipment, steps, diagram. C4.3 To present the results of the experiment. C4.4 To present a rigorous analysis of the results. C4.5 To discuss the results. C4.6 To write the conclusions of an experiment clearly, relating them to the problem stated. C4.7 To clearly and logically present all the parts of a report.</p>

Table 8: Programs of study cited in this document

Title	Date of Publication	Document Code
<i>Physical Science Program: Secondary IV</i>	October 1997	38-8312-A
<i>Chemistry Program: Secondary V</i>	July 1999	38-8318-A
<i>Physics Program: Secondary V</i>	February 2000	38-8313-A
<i>Biology: Secondary V</i>	March 2004	41-9000-A

Table 9: *Definitions of the Domain for Summative Evaluation* for courses in science programs

Program	Course	Date of Publication	Document Code
<i>Physical Science Program: Secondary IV</i>	PSC-4010-2	November 1998	38-8817-A
	PSC-4011-2	November 1998	38-8818-A
	PSC-4012-2	November 1998	38-8816-A
<i>Chemistry Program: Secondary V</i>	CHE-5041-2	November 1999 (out-of-date) January 2004	38-8791-A 41-9010-A
	CHE-5042-2	November 1999 (out-of-date) January 2004	38-8792-A 41-9011-A
	CHE-5043-2	November 1999 (out-of-date) January 2004	38-8793-A 41-9012-A
<i>Physics Program: Secondary V</i>	PHS-5041-2	July 2000 (out-of-date) January 2004	38-3990-A 41-9013-A
	PHS-5042-2	July 2000 (out-of-date) January 2004	38-3988-A 41-9014-A
	PHS-5043-2	July 2000 (out-of-date) January 2004	41-1036-A 41-9015-A
<i>Biology: Secondary V</i>	BLG-5061-1	March 2004	41-9001-A
	BLG-5062-2	March 2004	41-9002-A
	BLG-5063-2	March 2004	41-9003-A
	BLG-5064-2	March 2004	41-9004-A
	BLG-5065-2	March 2004	41-9005-A
	BLG-5066-1	March 2004	41-9006-A
	BLG-5067-1	March 2004	41-9007-A
	BLG-5068-2	March 2004	41-9081-A
	BLG-5069-1	March 2004	41-9009-A

Table 10: Division of responsibilities for summative evaluation for each course in the science programs

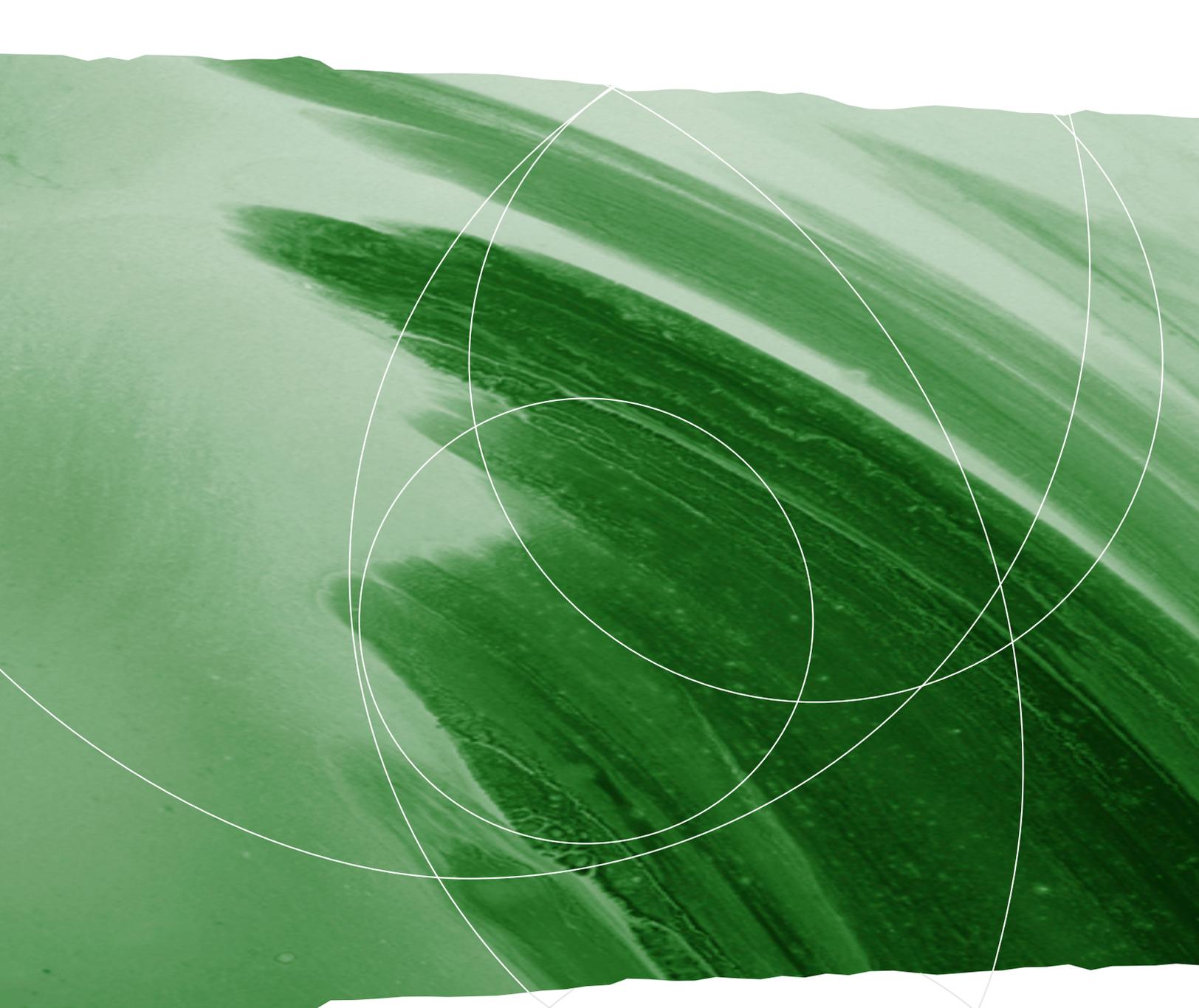
Program	Course	Developing Examinations	Type of Examination
<i>Physical Science Program: Secondary IV</i>	PSC-4010-2	MELS	Ministry
	PSC-4011-2	MELS	Ministry
	PSC-4012-2	MELS	Ministry
<i>Chemistry Program: Secondary V</i>	CHE-5041-2	Local	Local
	CHE-5042-2	Local	Local
	CHE-5043-2	Local	Local
<i>Physics Program: Secondary V</i>	PHS-5041-2	Local	Local
	PHS-5042-2	Local	Local
	PHS-5043-2	Local	Local
<i>Biology: Secondary V</i>	BLG-5061-1	Local	Local
	BLG-5062-2	Local	Local
	BLG-5063-2	Local	Local
	BLG-5064-2	Local	Local
	BLG-5065-2	Local	Local
	BLG-5066-1	Local	Local
	BLG-5067-1	Local	Local
	BLG-5068-2	Local	Local
	BLG-5069-1	Local	Local

Note

This table reflects the situation on June 30th, 2005.

Table 11: List of Web sites cited in this document

Ministère de l'Éducation, du Loisir et du Sport (MELS)	www.mels.gouv.qc.ca
Direction de la formation générale des adultes (DFGA)	www.mels.gouv.qc.ca/dfga
Direction de la sanction des études (DSE)	www.mels.gouv.qc.ca/sanction
Secteur de l'enseignement supérieur	www.mels.gouv.qc.ca/ens-sup
Société de formation à distance des commissions scolaires du Québec (SOFAD)	www.sofad.qc.ca
Société GRICS	www.grics.qc.ca
RÉCIT Provincial Service for General and Continuing Adult Education	www.recit-edumatic.qc.ca
English SitSat	www.recit-edumatic.qc.ca/english
Québec English Schools Network Recit	www.qesnrecit.qc.ca



Éducation,
Loisir et Sport

Québec



learning
throughout life

41-9016-A