

Technical Training Program

210.A0

# Laboratory Technology

Training Sector

6

Chemistry  
and Biology

**Reach** for  
your **Dreams**

Québec 





*Technical Training Program*

210.A0

# Laboratory Technology

Training Sector

6

Chemistry  
and Biology

Formation professionnelle et technique  
et formation continue

Direction générale des programmes  
et du développement

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**Type of certification:** Diploma of College Studies

<b>Number of credits:</b>	Specialization option A, Biotechnology	91 2/3
	Specialization option B, Analytical Chemistry	90 2/3

**Total duration:**

General education components:	660	hours of instruction
Program-specific component:		hours of instruction
Common core and Specialization option A, Biotechnology	2055	hours of instruction
Common core and Specialization option B, Analytical Chemistry :	1995	hours of instruction

**Prerequisites:**

- Mathematics 526
- Physics 534
- Chemistry 534



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## INTRODUCTION TO THE PROGRAM

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The *Laboratory Technology* program (210.A0) program is in keeping with the aims and orientations of technical education that guide the Direction générale de la formation professionnelle et technique. It has been designed in accordance with the framework for developing technical programs, which requires participation by people working in the field and in the education community.

This program is based on competencies, formulated in terms of objectives and standards. It was designed using an approach that takes into account training needs, the job analysis and the general goals of technical education, and it serves as the basis for the definition and evaluation of learning activities. In addition, it lends itself to the application of the program-based approach.

The *Laboratory Technology* program includes a general education component common to all programs (16 2/3 credits), a general education component adapted to this program (6 credits), a complementary general education component (4 credits) and a program-specific component of 65 credits in the *Biotechnology* specialization option and 64 credits in the *Analytical Chemistry* specialization option.

This document has two parts. Part One presents an overview of the program, and Part Two describes the objectives and standards for the general education components and the program-specific component.



## GLOSSARY

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### **Program**

An integrated set of learning activities leading to the achievement of educational objectives based on set standards (*College Education Regulations*, section 1).

### **Competency**

In the program-specific component of a technical program: an integrated set of cognitive and psychomotor skills and socioaffective behaviours that enable a student to exercise a role or function, perform a task or carry out an activity at entry level on the job market (*Cadre technique d'élaboration de la partie ministérielle des programmes d'études techniques*, p. 3).

### **Objective**

The competency, skills or knowledge to be acquired or mastered (*College Education Regulations*, section 1).

### **Statement of the competency**

In the program-specific component of a technical program, the statement of the competency is the result of the job analysis, the general goals of technical education and, in certain cases, other determinants. It consists of an action verb and a complement. It must be clear and unequivocal.

In the general education components, the statement of the competency is the result of an analysis of the needs of general education.

### **Elements of the competency**

In the program-specific component of a technical program, the elements of the competency include only what is necessary in order to understand the competency. They specify the major steps in exercising the competency or the main aspects of the competency.

In the general education components, the elements of the objective, formulated in terms of a competency, specify the main aspects of the competency. They include only what is necessary in order to understand and attain the competency.

## **Standard**

The level of performance at which an objective is considered to be achieved (*College Education Regulations*, section 1).

## **Achievement context**

In the program-specific component of a technical program, the achievement context corresponds to the situation in which the competency is exercised at entry level on the job market. The achievement context does not specify the context for learning or evaluation.

## **Performance criteria**

In the program-specific component of a technical program, the performance criteria define requirements by which to judge the attainment of each element of the competency and consequently of the competency itself. The performance criteria are based on the requirements at entry level on the job market. The performance criteria are not the evaluation instrument but, rather, they serve as a reference for the development of the evaluation instrument. Each element of the competency requires at least one performance criterion.

In the general education components, the performance criteria define the requirements for recognition of the attainment of the standard. All the criteria must be respected for the objective to be recognized as having been attained.

## **Learning activities**

In the program-specific component of a technical program, the learning activities are classes (or labs, workshops, seminars, practicums or other educational activities) designed to ensure the attainment of the targeted objectives and standards. Colleges are entirely responsible for defining the learning activities and applying the program-based approach.

In the general education components, the elements of the learning activities that may be determined in whole or in part by the Minister are the field of study, the discipline(s), the weightings, the total hours of instruction, the number of credits and any details deemed essential.



# PART ONE

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## GOALS OF THE PROGRAM

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The goal of the *Laboratory Technology* program is to provide students with the aptitudes to become laboratory technologists in manufacturing companies, particularly those in the agro-food, pharmaceutical and environmental sectors. In addition, the students will be capable of working in:

- biotechnology laboratories
- laboratories of companies in the industrial chemistry, mining, metallurgy, petrochemical, materials and pulp and paper sectors

As laboratory technologists they will be able to collect samples, perform organic chemical and biochemical analysis using certain instrumental analysis methods, compile and process data, write reports and submit results. All work will be done according to health and safety regulations observing Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).

Technologists specializing in biotechnology will be able to use microorganisms and cells; perform biochemical, microbiological and immunological analyses; perform activities associated with genetic analysis and conduct toxicity and ecotoxicity tests for the purpose of quality control, research and development as well as production.

Technologists specializing in analytical chemistry will be able to perform inorganic and organic chemical analyses and participate in the development of new analytical methods in the areas of quality control, research and development and production.

In keeping with the general goals of technical education, the program-specific component of the *Laboratory Technology* program is designed to:

- enable students to acquire competence in the exercise of the occupation, i.e. in carrying out the tasks and activities of the occupation at the level required for entry into the job market
- help students integrate into the working world by familiarizing them with the job market in general, and the fields of analytical chemistry and biotechnology in particular
- foster students' personal growth and encourage their continuing professional development
- ensure students' future job mobility by helping them to acquire career-management skills

The *Laboratory Technology* programs also support implementation of the educational intentions of the three components of general education: general education common to all programs, general education adapted to this program and complementary general education. In addition, the program is designed to develop the student's sense of responsibility, observation skills, attention to detail and ability to work in a team.

Finally, the program reconciles two training requirements, versatility and specialization. Versatility is ensured by the acquisition of general competencies that will allow the laboratory technologists to demonstrate independence in the fulfillment of their functions. These competencies will also help them in adapting to new work situations.

The students' mastery of technical skills, an absolute necessity for entering the job market, is ensured by the acquisition of specific skills directly linked with each of the two specialization options.

## **GOALS OF GENERAL EDUCATION**

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In Québec, college is the next stage after the compulsory years of schooling (elementary and secondary school) during which students acquire basic knowledge and skills. It represents a major crossroads in that it places greater emphasis on the cultural content of education and leads directly to the job market or to university. The college system meets current needs with respect to technical and pre-university education. It allows students to further their education without narrowing their options, since they may switch from one type of program to the other. Finally, it provides students with a well-rounded, balanced education.

General education is an integral part of every program and comprises three components: a component common to all programs, a component adapted to the particular program and a complementary component. The aim of general education is to provide students with a common cultural core, to help them learn and develop generic skills, and to foster desirable attitudes. Its purpose is to educate students as individuals, to prepare them for their role as responsible members of society and to enable them to share in the common cultural heritage.

### **Common cultural core**

The common cultural core comprises the following:

- mastery of the language of instruction as a tool for communication and reflection, and mastery of the basic rules of rational thought, discourse and argumentation
- the ability to communicate in another language, primarily French or English
- openness to the world and to cultural diversity
- appreciation of the riches of our cultural heritage through awareness of the accomplishments of human civilization
- the ability to relate to major currents in the history of human thought
- the ability to think independently and critically
- personal and social ethics
- knowledge concerning the development of physical and intellectual well-being
- awareness of the need to develop habits conducive to good health

### **Generic skills**

General education allows students to acquire and develop the following generic skills:

- conceptualization, analysis and synthesis
- coherent reasoning
- critical judgment
- articulate expression
- the ability to apply what they have learned to the analysis of situations

- the ability to apply what they have learned to decision making
- work methods
- the ability to reflect on what they have learned

### **Desirable attitudes**

The common cultural core and generic skills help students to acquire and develop the following attitudes:

- autonomy
- a critical sense
- awareness of their responsibilities toward themselves and others
- openmindedness
- creativity
- openness to the world

These aims apply to the three general education components:

- General education component common to all programs, which is allotted 16 2/3 credits distributed as follows:
  - language of instruction and literature: 7 1/3 credits
  - humanities or *philosophie*: 4 1/3 credits
  - physical education: 3 credits
  - second language: 2 credits
- General education component adapted to programs, which introduces tasks or learning situations that are relevant to the program-specific component of a program. The breakdown of credits, for a total of 6, is as follows:
  - language of instruction and literature: 2 credits
  - humanities or *philosophie*: 2 credits
  - second language: 2 credits
- Complementary general education component, which provides students with learning activities chosen to balance their training and complement the program-specific component. Students may choose courses for a total of 4 credits in the following areas:
  - social sciences
  - science and technology
  - modern languages
  - mathematics literacy and computer science
  - art and aesthetics

The knowledge and skills acquired in the general education components should be emphasized and, whenever possible, applied in the program-specific component, and vice-versa. Thus, general education and the program-specific component of a program enhance each other as they contribute to the students' overall education.

Each college-level institution must provide general education through learning activities that are consistent with its educational project, in keeping with the aims, subject areas and ministerial guidelines provided.

The objectives and standards in the general education components were developed according to the provisions of the *College Education Regulations* (R.S.Q., c. C-29, s. 18; 1993, c. 25, s. 11). Revised Edition, October 2001.





## **EDUCATIONAL INTENTIONS OF GENERAL EDUCATION**

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The educational intentions describe how each field of studies in the common, adapted and complementary components of general education contributes to achieving the goals of general education. For the common and adapted components, the educational intentions include:

- a general statement of the role of each field of studies
- the principles underlying this role
- outcome objectives defining (in terms of knowledge, skills and attitudes) the contribution of each field to the achievement of the goals of general education
- an explanation of the sequence of objectives and standards

The full text of the educational intentions may be found at the end of this document.



## PROGRAM OBJECTIVES

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### GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS

(16 2/3 credits)

- 0004 To analyze and produce various forms of discourse.
- 0005 To apply a critical approach to literary genres.
- 0006 To apply a critical approach to a literary theme.
- 00B2 To apply a logical analytical process to how knowledge is organized and used.
- 000G To apply a critical thought process to world-views.
- 0017 Appliquer les notions de base de la communication en français courant.  
or
- 000A Communiquer en français avec une certaine aisance.  
or
- 000B Communiquer avec aisance en français.  
or
- 000C Traiter d'un sujet culturel et littéraire.
- 0064 To establish the role that being physically active plays amongst the lifestyle behaviours which promote health.
- 0065 To improve one's effectiveness when practising a physical activity.
- 0066 To demonstrate one's responsibility for being physically active in a manner which promotes health.

**GENERAL EDUCATION COMPONENT ADAPTED TO THIS PROGRAM****(6 credits)**

000L To communicate in the forms of discourse appropriate to one or more fields of study.

000U To apply a critical thought process to ethical issues relevant to the field of study.

0018 Appliquer des notions fondamentales de la communication en français, liées à un champ d'études.

or

000Q Communiquer en français dans un champ d'études particulier.

or

000R Communiquer avec aisance en français dans un champ d'études particulier.

or

000S Dissserter en français sur un sujet lié au champ d'études.

**COMPLEMENTARY GENERAL EDUCATION COMPONENT****(4 credits)**

000V To estimate the contribution of the social sciences to an understanding of contemporary issues.

000W To analyze one of the major problems of our time using one or more social scientific approaches.

000X To explain the general nature of science and technology and some of the major contemporary scientific or technological issues.

000Y To resolve a simple problem by applying the basic scientific method.

000Z To communicate with limited skill in a modern language.

0010 To communicate on familiar topics in a modern language.

0067 To communicate with relative ease in a modern language.

0011 To recognize the role of mathematics or informatics in contemporary society.

0012 To use various mathematical or computer concepts, procedures and tools for common tasks.

0013 To consider various forms of art produced by aesthetic practices.

0014 To produce a work of art.

## PROGRAM-SPECIFIC COMPONENT

### Common Core

- 01DP To analyze the occupations.
- 01E0 To maintain standards of quality.
- 01E1 To prepare solutions.
- 01E2 To assess data statistically.
- 01E3 To identify organic molecules.
- 01E4 To characterize biomolecules.
- 01E5 To detect microorganisms.
- 01E6 To manage chemicals and materials.
- 01DQ To use math tools necessary for analysis.
- 01DR To understand how the equipment operates.
- 01DS To use general chemistry principles necessary for analysis interpretation.
- 01DT To interpret analysis protocols.
- 01DU To collect samples.
- 01DV To take physiochemical measurements.
- 01DW To take electrometric measurements.
- 01DX To perform organic and biochemical analyses using capillary electrophoresis.
- 01DY To perform organic chemistry and biochemistry analysis using molecular spectrometry.
- 01DZ To perform organic chemistry and biochemistry analyses using instrumental chromatography.

### Specialization option A, Biotechnology

- 01E7 To characterize anatomical and physiological information.
- 01E8 To apply immunological techniques.
- 01F1 To apply molecular biology techniques.
- 01EA To identify microorganisms.
- 01EB To use laboratory animals.
- 01EC To culture animal cells.
- 01ED To culture plant cells.
- 01EE To perform applied immunological analyses.
- 01EF To perform toxicological and ecotoxicological analyses.
- 01EG To perform applied biochemical analyses.
- 01EH To perform applied microbiological analyses.
- 01EJ To perform activities related to genetic engineering.
- 01EK To use cells in bioprocesses.

Specialization option B, Analytical Chemistry

- 01EL To characterize the chemical processes used in Québec's main industries.
- 01EM To use automated devices.
- 01EN To prepare samples.
- 01EP To perform gravimetric analyses.
- 01EQ To perform titrimetric analyses.
- 01ER To perform electrochemical analyses.
- 01ES To perform atomic spectrometry analyses.
- 01ET To perform thermal analyses.
- 01EU To perform organic and inorganic chemical analyses using instrumental and manual methods.

## HARMONIZATION

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The technical programs, *Laboratory Technology* (210.A0) and *Biomedical Laboratory Technology* (140.B0) have been harmonized. The purpose of harmonization is to optimize the students' progress in their training by making it easier for them to go from one program to another or from one level of education to another without duplication of learning content.

The table of harmonized competencies will be printed separately.





## PART TWO

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**OBJECTIVES AND STANDARDS –  
GENERAL EDUCATION COMPONENT  
COMMON TO ALL PROGRAMS**

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GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS: CODE: 0004  
LANGUAGE OF INSTRUCTION AND LITERATURE

OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To analyze and produce various forms of discourse.</p> <p><b>Elements of the Competency</b></p> <p>1 To identify the characteristics and functions of the components of discourse.</p> <p>2 To determine the organization of facts and arguments of a given discourse.</p> <p>3 To prepare ideas and strategies for a projected discourse.</p> <p>4 To formulate a discourse.</p> <p>5 To edit the discourse.</p>	<p><b>Performance Criteria</b></p> <p>1.1 Accurate explanation of the denotation of words.</p> <p>1.2 Adequate recognition of the appropriate connotation of words.</p> <p>1.3 Accurate definition of the characteristics and function of each component.</p> <p>2.1 Clear and accurate recognition of the main idea and structure.</p> <p>2.2 Clear presentation of the strategies employed to develop an argument or thesis.</p> <p>3.1 Appropriate identification of topics and ideas.</p> <p>3.2 Adequate gathering of pertinent information.</p> <p>3.3 Clear formulation of a thesis.</p> <p>3.4 Coherent ordering of supporting material.</p> <p>4.1 Appropriate choice of tone and diction.</p> <p>4.2 Correct development of sentences.</p> <p>4.3 Clear and coherent development of paragraphs.</p> <p>4.4 Formulation of a 750-word discourse.</p> <p>5.1 Thorough revision of form and content.</p>
LEARNING ACTIVITIES	
<p><b>Discipline:</b> English</p> <p><b>Weighting:</b> 2-2-4, 1-3-4</p> <p><b>Credits:</b> 2 2/3</p>	

GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS: CODE: 0005  
LANGUAGE OF INSTRUCTION AND LITERATURE

OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To apply a critical approach to literary genres.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1 To distinguish genres of literary discourse.</li> <li>2 To recognize the use of literary conventions within a specific genre.</li> <li>3 To situate a discourse within its historical and literary period.</li> <li>4 To explicate a discourse representative of a literary genre.</li> </ol>	<p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Clear recognition of the formal characteristics of a literary genre.</li> <li>2.1 Accurate recognition of the figurative communication of meaning.</li> <li>2.2 Adequate explanation of the effects of significant literary and rhetorical devices.</li> <li>3.1 Appropriate recognition of the relationship of a text to its period.</li> <li>4.1 Selective use of appropriate terminology.</li> <li>4.2 Effective presentation of a 1000-word integrated response to a text.</li> </ol>
LEARNING ACTIVITIES	
<p><b>Discipline:</b> English</p> <p><b>Weighting:</b> 2-2-3</p> <p><b>Credits:</b> 2 1/3</p>	

GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS: CODE: 0006 LANGUAGE OF INSTRUCTION AND LITERATURE	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To apply a critical approach to a literary theme.</p> <p><b>Elements of the Competency</b></p> <p>1 To recognize the treatment of a theme within a literary text.</p> <p>2 To situate a literary text within its cultural context.</p> <p>3 To detect the value system inherent in a literary text.</p> <p>4 To explicate a text from a thematic perspective.</p>	<p><b>Performance Criteria</b></p> <p>1.1 Clear recognition of elements within the text which define and reinforce a theme and its development.</p> <p>1.2 Adequate demonstration of the effects of significant literary and rhetorical devices.</p> <p>2.1 Appropriate recognition of a text as an expression of cultural context.</p> <p>2.2 Adequate demonstration of the effects of significant literary and rhetorical devices.</p> <p>3.1 Appropriate identification of expression (explicit/implicit) of a value system in a text.</p> <p>4.1 Selective use of an appropriate terminology.</p> <p>4.2 Effective presentation of a 1000-word integrated response to a text.</p>
LEARNING ACTIVITIES	
<p><b>Discipline:</b> English</p> <p><b>Weighting:</b> 2-2-3</p> <p><b>Credits:</b> 2 1/3</p>	

GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS: HUMANITIES CODE: 00B2	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To apply a logical analytical process to how knowledge is organized and used.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1 To recognize the basic elements of a field of knowledge.</li> <li>2 To define the modes of organization and utilization of a field of knowledge.</li> <li>3 To situate a field of knowledge within its historical context.</li> <li>4 To organize the main components into coherent patterns.</li> <li>5 To produce a synthesis of the main components.</li> </ol>	<p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Appropriate description of the basic elements.</li> <li>1.2 Appropriate use of terminology relevant to fields of knowledge.</li> <li>2.1 Adequate definition of the dimensions, limits, and uses of fields of knowledge.</li> <li>3.1 Accurate identification of the main components in the historical development of fields of knowledge.</li> <li>3.2 Accurate description of the effects of historical development and societal milieu on the limitations and uses of a field of knowledge.</li> <li>4.1 Coherent organization of the main components.</li> <li>5.1 Appropriate analysis of the components.</li> <li>5.2 Coherent synthesis of the main components.</li> <li>5.3 Appropriate expression, including a significant individual written component, of an analysis of the context, importance and implications of the organization and uses of knowledge.</li> </ol>
LEARNING ACTIVITIES	
<p><b>Discipline:</b> Humanities</p> <p><b>Weighting:</b> 3-1-3</p> <p><b>Credits:</b> 2 1/3</p>	



GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS: HUMANITIES CODE: 000G	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To apply a critical thought process to world-views.</p> <p><b>Elements of the Competency</b></p> <p>1 To describe world-views.</p> <p>2 To explain the major ideas, values, and implications of a world-view.</p> <p>3 To organize the ideas, values and experiences of a world-view into coherent patterns.</p> <p>4 To compare world-views.</p>	<p><b>Performance Criteria</b></p> <p>1.1 Accurate description of a society or group with a distinctive world-view.</p> <p>1.2 Appropriate use of terminology relevant to these societies or groups.</p> <p>2.1 Adequate explanation of the salient components of a world-view.</p> <p>3.1 Coherent organization of ideas about a world-view.</p> <p>3.2 Appropriate expression, including a significant individual written component, of an analysis of the context, importance, and implications of world-views.</p> <p>4.1 Comparative analysis of these world-views.</p> <p>4.2 Appropriate inclusion of central elements, relationships, and organizational principles of the societies or groups in the analysis.</p>
LEARNING ACTIVITIES	
<p><b>Discipline:</b> Humanities</p> <p><b>Weighting:</b> 3-0-3</p> <p><b>Credits:</b> 2</p>	

FORMATION GÉNÉRALE COMMUNE : LANGUE SECONDE (NIVEAU I) CODE: 0017

OBJECTIF	STANDARD
<p><b>Énoncé de la compétence</b></p> <p>Appliquer les notions de base de la communication en français courant.</p> <p><b>Éléments</b></p> <p>1 Dégager le sens d'un message oral simple.</p> <p>2 Émettre un message oral simple.</p> <p>3 Dégager le sens d'un texte.</p> <p>4 Rédiger un texte simple.</p>	<p><b>Critères de performance</b></p> <p>1.1 Repérage précis des difficultés de compréhension du message.</p> <p>1.2 Utilisation pertinente des techniques d'écoute choisies.</p> <p>1.3 Distinction précise du sens général et des idées essentielles du message.</p> <p>1.4 Description précise du sens général et des idées essentielles du message.</p> <p>2.1 Repérage précis des difficultés d'expression.</p> <p>2.2 Utilisation pertinente des techniques d'expression orales choisies.</p> <p>2.3 Emploi pertinent du vocabulaire courant.</p> <p>2.4 Expression intelligible du propos.</p> <p>3.1 Repérage précis des difficultés de compréhension du texte.</p> <p>3.2 Utilisation pertinente des techniques de lecture choisies.</p> <p>3.3 Distinction claire des principaux éléments du texte.</p> <p>3.4 Description précise du sens général et des idées essentielles d'un texte de 500 mots.</p> <p>4.1 Repérage précis des difficultés d'écriture.</p> <p>4.2 Utilisation pertinente des techniques d'écriture choisies.</p> <p>4.3 Emploi pertinent du vocabulaire courant.</p> <p>4.4 Formulation claire et cohérente d'un texte de 100 mots.</p>
LEARNING ACTIVITIES	
<p><b>Discipline :</b> Français, langue seconde</p> <p><b>Pondération :</b> 2-1-3</p> <p><b>Unités :</b> 2</p>	

FORMATION GÉNÉRALE COMMUNE : LANGUE SECONDE (NIVEAU II) CODE: 000A

OBJECTIF	STANDARD
<p><b>Énoncé de la compétence</b></p> <p>Communiquer en français avec une certaine aisance.</p> <p><b>Éléments</b></p> <p>1 Interpréter un texte oral simple de trois minutes en français courant.</p> <p>2 Produire un texte oral planifié de cinq minutes en français courant.</p> <p>3 Interpréter un texte écrit en français courant.</p> <p>4 Rédiger un texte simple en français courant.</p>	<p><b>Critères de performance</b></p> <p>1.1 Distinction claire des principaux éléments du texte oral.</p> <p>1.2 Explication précise du sens des mots dans le texte.</p> <p>1.3 Repérage précis des idées et des sujets traités dans le texte.</p> <p>2.1 Emploi pertinent du vocabulaire courant.</p> <p>2.2 Respect du niveau de langue, du code grammatical et des règles de la prononciation.</p> <p>2.3 Formulation claire et cohérente du propos.</p> <p>3.1 Distinction claire des principaux éléments du texte.</p> <p>3.2 Explication précise du sens des mots dans le texte.</p> <p>3.3 Repérage précis des idées principales et de la structure d'un texte de 700 à 1000 mots.</p> <p>4.1 Respect du code grammatical et orthographique.</p> <p>4.2 Utilisation judicieuse des principaux éléments du corpus.</p> <p>4.3 Formulation claire et cohérente des phrases.</p> <p>4.4 Articulation cohérente des paragraphes.</p> <p>4.5 Rédaction d'un texte de 200 mots.</p>
LEARNING ACTIVITIES	
<p><b>Discipline :</b> Français, langue seconde</p> <p><b>Pondération :</b> 2-1-3</p> <p><b>Unités :</b> 2</p>	

FORMATION GÉNÉRALE COMMUNE : LANGUE SECONDE (NIVEAU III) CODE: 000B

OBJECTIF	STANDARD
<p><b>Énoncé de la compétence</b></p> <p>Communiquer avec aisance en français.</p> <p><b>Éléments</b></p> <p>1 Produire un texte oral planifié de cinq minutes de complexité moyenne.</p> <p>2 Commenter un texte écrit de complexité moyenne.</p> <p>3 Rédiger un texte de complexité moyenne.</p>	<p><b>Critères de performance</b></p> <p>1.1 Emploi pertinent du vocabulaire courant.</p> <p>1.2 Adaptation à l'interlocuteur ou à l'interlocutrice.</p> <p>1.3 Respect du niveau de langue, du code grammatical et des règles de la prononciation.</p> <p>1.4 Formulation claire et cohérente du propos.</p> <p>1.5 Agencement pertinent des idées.</p> <p>2.1 Distinction claire des principaux éléments d'un texte comprenant entre 2 500 et 3 000 mots.</p> <p>2.2 Explication précise du sens des mots dans le texte.</p> <p>2.3 Distinction précise des idées principales et secondaires, des faits et des opinions.</p> <p>2.4 Formulation d'éléments implicites.</p> <p>3.1 Respect du code grammatical et orthographique.</p> <p>3.2 Adaptation au lecteur ou à la lectrice.</p> <p>3.3 Utilisation judicieuse des principaux éléments du corpus.</p> <p>3.4 Formulation claire et cohérente des phrases, dont au moins trois sont complexes.</p> <p>3.5 Articulation cohérente des paragraphes.</p> <p>3.6 Rédaction d'un texte de 350 mots.</p>
LEARNING ACTIVITIES	
<p><b>Discipline :</b> Français, langue seconde</p> <p><b>Pondération :</b> 2-1-3</p> <p><b>Unités :</b> 2</p>	

FORMATION GÉNÉRALE COMMUNE : LANGUE SECONDE (NIVEAU IV) CODE: 000C	
OBJECTIF	STANDARD
<p><b>Énoncé de la compétence</b></p> <p>Traiter d'un sujet culturel et littéraire.</p> <p><b>Éléments</b></p> <p>1 Analyser un texte culturel ou littéraire.</p> <p>2 Rédiger un texte sur un sujet culturel ou littéraire.</p>	<p><b>Critères de performance</b></p> <p>1.1 Formulation personnelle des éléments principaux du texte.</p> <p>1.2 Inventaire des thèmes principaux.</p> <p>1.3 Relevé d'indices qui permettent de situer le texte dans son contexte socioculturel et historique.</p> <p>1.4 Repérage des valeurs véhiculées.</p> <p>1.5 Repérage juste de la structure du texte.</p> <p>1.6 Articulation claire d'un point de vue personnel.</p> <p>2.1 Respect du sujet.</p> <p>2.2 Respect du code grammatical et orthographique.</p> <p>2.3 Adaptation au lecteur ou à la lectrice.</p> <p>2.4 Utilisation judicieuse des principaux éléments du corpus.</p> <p>2.5 Formulation claire et cohérente d'un texte de 500 mots.</p> <p>2.6 Articulation claire d'un point de vue personnel.</p>
LEARNING ACTIVITIES	
<p><b>Discipline :</b> Français, langue seconde</p> <p><b>Pondération :</b> 3-0-3</p> <p><b>Unités :</b> 2</p>	

GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS: PHYSICAL EDUCATION		CODE: 0064
OBJECTIVE		STANDARD
<b>Statement of the Competency</b>  To establish the role that being physically active plays amongst the lifestyle behaviours which promote health.		
<b>Elements of the Competency</b> 1 To establish the relationship between one's lifestyle and one's health.  2 To be physically active in a manner which promotes health.  3 To recognize one's needs, abilities, and motivational factors with respect to being physically active on a regular basis.  4 To propose physical activities which promote health.		<b>Performance Criteria</b> 1.1 Proper use of documentation. 1.2 Appropriate relationships between the main lifestyle behaviours and their impact on health. 2.1 Observance of the rules involved in the physical activity, including safety guidelines. 2.2 Respect of one's abilities when practising physical activities. 3.1 Appropriate use of the physical quantitative and qualitative data. 3.2 Statement of one's main physical needs and abilities. 3.3 Statement of one's main motivational factors with respect to being physically active on a regular basis. 4.1 Appropriate and justified choice of physical activities according to one's needs, abilities, and motivational factors.
LEARNING ACTIVITIES		
<b>Discipline:</b> Physical Education <b>Weighting:</b> 1-1-1 <b>Credits:</b> 1		

GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS: PHYSICAL EDUCATION		CODE: 0065
OBJECTIVE		STANDARD
<b>Statement of the Competency</b>  To improve one's effectiveness when practising a physical activity.  <b>Elements of the Competency</b> 1 To use a process designed to improve one's effectiveness in the practice of a physical activity.		<b>Performance Criteria</b> 1.1 Initial assessment of one's abilities and attitudes when practising a physical activity. 1.2 Statement of one's expectations and needs with respect to one's ability to practise the activity. 1.3 Appropriate formulation of personal objectives. 1.4 Statement of the means to achieve one's objectives. 1.5 Observance of the rules involved in the physical activity, including safety guidelines. 1.6 Periodic evaluation of one's abilities and attitudes when practising a physical activity. 1.7 Meaningful interpretation of the progress achieved and the difficulties experienced during the activity. 1.8 Pertinent and periodic adjustments of objectives or action plan. 1.9 Appreciable improvement of the motor skills required by the activity.
LEARNING ACTIVITIES		
<b>Discipline:</b> Physical Education <b>Weighting:</b> 0-2-1 <b>Credits:</b> 1		

GENERAL EDUCATION COMPONENT COMMON TO ALL PROGRAMS: PHYSICAL EDUCATION		CODE: 0066
OBJECTIVE		STANDARD
<b>Statement of the Competency</b>  To demonstrate one's responsibility for being physically active in a manner which promotes health.		
<b>Elements of the Competency</b> 1 To combine effective practice with a health promotional approach to physical activity.  2 To manage a personal physical activity program.		<b>Performance Criteria</b> 1.1 Integration of effective practice with factors which promote health in the practice of a physical activity. 2.1 Statement of one's priorities according to the needs, abilities, and motivational factors with respect to being active on a regular basis. 2.2 Proper formulation of objectives to achieve in one's personal program. 2.3 Appropriate choice of activity or activities for one's personal program. 2.4 Appropriate planning of how the activity or activities in the personal program are carried out. 2.5 Appropriate choice of criteria to measure program objective attainment. 2.6 Periodic statement of the time invested and the activities carried out during the program. 2.7 Meaningful interpretation of the progress achieved and difficulties experienced during the activity. 2.8 Appropriate and periodic adjustment of objectives or action plan.
LEARNING ACTIVITIES		
<b>Discipline:</b> Physical Education <b>Weighting:</b> 1-1-1 <b>Credits:</b> 1		



**OBJECTIVES AND STANDARDS –  
GENERAL EDUCATION COMPONENT  
ADAPTED TO THIS PROGRAM**

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GENERAL EDUCATION COMPONENT ADAPTED TO THIS PROGRAM: CODE: 000L  
LANGUAGE OF INSTRUCTION AND LITERATURE

OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To communicate in the forms of discourse appropriate to one or more fields of study.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1 To identify the forms of discourse appropriate to given fields of study.</li> <li>2 To recognize the discursive frameworks appropriate to given fields of study.</li> <li>3 To formulate a discourse.</li> </ol>	<p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Accurate recognition of specialized vocabulary and conventions.</li> <li>1.2 Accurate recognition of the characteristics of the form of discourse.</li> <li>2.1 Clear and accurate recognition of the main ideas and structure.</li> <li>2.2 Appropriate distinction between fact and argument.</li> <li>3.1 Appropriate choice of tone and diction.</li> <li>3.2 Correctly developed sentences.</li> <li>3.3 Clearly and coherently developed paragraphs.</li> <li>3.4 Appropriate use of program-related communication strategies.</li> <li>3.5 Formulation of a 1000-word discourse.</li> <li>3.6 Thorough revision of form and content.</li> </ol>
LEARNING ACTIVITIES	
<p><b>Discipline:</b> English</p> <p><b>Total Contact Hours:</b> 60</p> <p><b>Credits:</b> 2</p>	

GENERAL EDUCATION COMPONENT ADAPTED TO THIS PROGRAM: HUMANITIES CODE: 000U	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To apply a critical thought process to ethical issues relevant to the field of study.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1 To situate significant ethical issues, in appropriate world-views and fields of knowledge.</li> <li>2 To explain the major ideas, values, and social implication of ethical issues.</li> <li>3 To organize the ethical questions and their implications into coherent patterns.</li> <li>4 To debate the ethical issues.</li> </ol>	<p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Accurate recognition of the basic elements of ethical issues.</li> <li>1.2 Appropriate use of relevant terminology.</li> <li>1.3 Adequate identification of the main linkages with world-views and fields of knowledge.</li> <li>2.1 Adequate description of the salient components of the issues.</li> <li>3.1 Coherent organization of the ethical questions and their implications.</li> <li>3.2 Appropriate expression, including a significant individual written component, of an analysis of the context, importance and implications of the issues.</li> <li>4.1 Adequate development of substantiated argumentation including context and diverse points of view.</li> <li>4.2 Clear articulation of an individual point of view.</li> </ol>
LEARNING ACTIVITIES	
<p><b>Discipline:</b> Humanities</p> <p><b>Total Contact Hours:</b> 45</p> <p><b>Credits:</b> 2</p>	

FORMATION GÉNÉRALE PROPRE : LANGUE SECONDE (NIVEAU I)		CODE: 0018
OBJECTIF		STANDARD
<b>Énoncé de la compétence</b>  Appliquer des notions fondamentales de la communication en français, liées à un champ d'études. <b>Éléments</b> 1 Dégager le sens d'un message oral simple lié à un champ d'études.  2 Dégager le sens et les caractéristiques d'un texte lié à un champ d'études.  3 Émettre un message oral simple lié à un champ d'études.  4 Rédiger un court texte lié à un champ d'études.		<b>Critères de performance</b>  1.1 Repérage précis des difficultés de compréhension du message. 1.2 Distinction juste des caractéristiques du message. 1.3 Repérage juste du vocabulaire spécialisé. 1.4 Utilisation pertinente des techniques d'écoute choisies. 1.5 Distinction claire des principaux éléments du message. 1.6 Description précise du sens général et des idées essentielles du message. 2.1 Repérage précis des difficultés de compréhension du texte. 2.2 Distinction juste des caractéristiques du texte. 2.3 Repérage précis du vocabulaire spécialisé. 2.4 Utilisation pertinente des techniques de lectures choisies. 2.5 Distinction claire des principaux éléments du texte. 2.6 Description précise du sens général et des idées essentielles du texte. 3.1 Repérage précis des difficultés d'expression orale. 3.2 Utilisation pertinente des techniques d'expression orale choisies. 3.3 Utilisation pertinente du vocabulaire courant et spécialisé. 3.4 Expression intelligible du propos. 4.1 Repérage précis des difficultés d'écrire. 4.2 Utilisation pertinente des techniques d'écriture choisies. 4.3 Utilisation pertinente du vocabulaire courant et spécialisé. 4.4 Formulation claire et cohérente du texte.
ACTIVITÉS D'APPRENTISSAGE		
<b>Discipline :</b>		Français, langue seconde
<b>Nombre d'heures-contact :</b>		45
<b>Nombre d'unités :</b>		2

FORMATION GÉNÉRALE PROPRE : LANGUE SECONDE (NIVEAU II)		CODE: 000Q
OBJECTIF	STANDARD	
<b>Énoncé de la compétence</b>  Communiquer en français dans un champ d'études particulier.  <b>Éléments</b>  1 Distinguer les types de textes propres au champ d'études.  2 Interpréter des textes représentatifs du champ d'études.        3 Utiliser des techniques de production de textes appropriées au champ d'études.	<b>Critères de performance</b>  1.1 Distinction précise des caractéristiques formelles de chacun des principaux types de textes et des conventions utilisées.  2.1 Distinction claire des principaux éléments du texte.  2.2 Interprétation claire du vocabulaire spécialisé.  2.3 Repérage précis des idées et des sujets traités.  2.4 Utilisation pertinente des techniques de lecture et d'écoute.  3.1 Emploi pertinent du vocabulaire spécialisé et des conventions.  3.2 Respect du niveau de langue et du code grammatical.  3.3 Formulation claire et cohérente du propos.  3.4 Utilisation pertinente des techniques d'expression.	
ACTIVITÉS D'APPRENTISSAGE		
<b>Discipline :</b>	Français, langue seconde	
<b>Nombre d'heures-contact :</b>	45	
<b>Nombre d'unités :</b>	2	







**OBJECTIVES AND STANDARDS –  
COMPLEMENTARY GENERAL EDUCATION  
COMPONENT**

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COMPLEMENTARY GENERAL EDUCATION COMPONENT: SOCIAL SCIENCES CODE: 000V	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To estimate the contribution of the social sciences to an understanding of contemporary issues.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1 Recognize the focus of one or more of the social sciences and their main approaches.</li> <li>2 Identify some of the issues currently under study in the social sciences.</li> <li>3 Demonstrate the contribution of one or more of the social sciences to an understanding of contemporary issues.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Students will work alone.</li> <li>• They will write an essay of approximately 750 words on the contribution of the social sciences to an understanding of contemporary issues.</li> <li>• Documents and data from the field of social sciences may be used.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Formulation of the focus specific to one or more of the social sciences.</li> <li>1.2 Description of the main approaches used in the social sciences.</li> <li>2.1 Association of issues with the pertinent areas of research in the social sciences.</li> <li>3.1 Presentation of contemporary issues by emphasizing the interpretation of the social sciences.</li> <li>3.2 Illustration of the interaction between certain social changes and the contribution of the social sciences.</li> </ol>
LEARNING ACTIVITIES	
<p><b>Number of student-contact hours:</b> 45</p> <p><b>Number of credits:</b> 2</p>	

COMPLEMENTARY GENERAL EDUCATION COMPONENT: SOCIAL SCIENCES CODE: 000W	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To analyze one of the major problems of our time using one or more social scientific approaches.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1 Formulate a problem using one or more social scientific approaches.</li> <li>2 Deal with an issue using one or more social scientific approaches.</li> <li>3 Draw conclusions.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Students will work alone.</li> <li>• They will write an essay of approximately 750 words on a topic related to human existence.</li> <li>• Reference materials from the field of social sciences may be used.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Presentation of the background to the problem.</li> <li>1.2 Use of appropriate concepts and language.</li> <li>1.3 Brief description of individual, collective, spatiotemporal and cultural aspects of the problem.</li> <li>2.1 Clear formulation of an issue.</li> <li>2.2 Selection of pertinent reference materials.</li> <li>2.3 Brief description of historical, experimental and survey methods.</li> <li>3.1 Appropriate use of the selected method.</li> <li>3.2 Determination of appropriate evaluation criteria.</li> <li>3.3 Identification of strengths and weaknesses of the conclusions.</li> </ol>
LEARNING ACTIVITIES	
<p><b>Number of student-contact hours:</b> 45</p> <p><b>Number of credits:</b> 2</p>	

COMPLEMENTARY GENERAL EDUCATION COMPONENT: SCIENCE AND TECHNOLOGY		CODE: 000X
OBJECTIVE	STANDARD	
<b>Statement of the Competency</b>  To explain the general nature of science and technology and some of the major contemporary scientific or technological issues.  <b>Elements of the Competency</b>  1 Describe the standard scientific mode of thought and method.  2 Demonstrate how science and technology are complementary.  3 Explain the context and the stages related to several scientific and technological discoveries.  4 Deduce different consequences and questions resulting from certain recent scientific and technological developments.	<b>Achievement Context</b>  <ul style="list-style-type: none"><li>Students will work alone.</li><li>They will use a written commentary on a scientific discovery or technological development.</li><li>They will write an essay of approximately 750 words.</li></ul> <b>Performance Criteria</b>  1.1 Brief description of the essential characteristics of the scientific mode of thought, including quantification and demonstration.  1.2 Organized list and brief description of the essential characteristics of the main steps in the standard scientific method.  2.1 Definition of terms and description of the primary ways in which science, techniques and technology are interrelated: logical and temporal connections, and mutual contributions.  3.1 Pertinent and coherent explanation of the relationship between the determining contexts related to several scientific and technological discoveries.  3.2 List of the main stages of scientific and technological discoveries.  4.1 Brief description of important consequences (of different types) and the current major challenges resulting from several scientific and technological discoveries.  4.2 Formulation of relevant questions and credibility of responses to the questions formulated.	
LEARNING ACTIVITIES		
<b>Number of student-contact hours:</b> 45 <b>Number of credits:</b> 2		

COMPLEMENTARY GENERAL EDUCATION COMPONENT: SCIENCE AND TECHNOLOGY		CODE: 000Y
OBJECTIVE	STANDARD	
<b>Statement of the Competency</b>  To resolve a simple problem by applying the basic scientific method.	<b>Achievement Context</b> <ul style="list-style-type: none"><li>• Students will work alone or in groups.</li><li>• They will be given a scientific and technological problem that is not complex and that can be resolved by applying the standard scientific method.</li><li>• Common scientific instruments and reference materials (written or other) may be used.</li></ul>	
<b>Elements of the Competency</b>  1 Describe the main steps of the standard scientific method.  2 Formulate a hypothesis designed to solve a simple scientific and technological problem.  3 Verify a hypothesis by applying the fundamental principles of the basic experimental method.	<b>Performance Criteria</b>  1.1 Organized list and brief description of the characteristics of the steps of the standard scientific method.  2.1 Clear, precise description of the problem. 2.2 Observance of the principles for formulating a hypothesis (observable and measurable nature of data, credibility, etc.).  3.1 Pertinence, reliability and validity of the experimental method used. 3.2 Observance of established experimental method. 3.3 Appropriate choice and use of instruments. 3.4 Clear, satisfactory presentation of results. 3.5 Validity of the connections established between the hypothesis, the verification and the conclusion.	
LEARNING ACTIVITIES		
<b>Number of student-contact hours:</b>	45	
<b>Number of credits:</b>	2	

COMPLEMENTARY GENERAL EDUCATION COMPONENT: MODERN LANGUAGES		CODE: 000Z
OBJECTIVE	STANDARD	
<b>Statement of the Competency</b>  To communicate with limited skill* in a modern language.  (*This refers to the limited use of language structures, grammar and vocabulary. This limitation varies depending on the complexity of the modern language.)  <b>Elements of the Competency</b>  1 Understand the meaning of a verbal message.   		

COMPLEMENTARY GENERAL EDUCATION COMPONENT: MODERN LANGUAGES		CODE: 0010
OBJECTIVE	STANDARD	
<b>Statement of the Competency</b>  To communicate on familiar topics in a modern language.	<b>Achievement Context</b> <ul style="list-style-type: none"><li>Students will have a conversation that includes at least 15 lines of dialogue.</li><li>They will write a text consisting of at least 20 sentences for Latin-alphabet languages.</li><li>They will write a text consisting of at least 10 sentences for languages not using the Latin alphabet.</li><li>Students will be exposed to:<ul style="list-style-type: none"><li>common situations in everyday life</li><li>simple topics from everyday life</li></ul></li><li>Reference materials may be used.</li></ul>	
<b>Elements of the Competency</b> 1 Understand the meaning of a verbal message.	<b>Performance Criteria</b> The acquisition of a modern language requires an awareness of the culture of the people who use the language.  1.1 Accurate identification of words and idiomatic expressions. 1.2 Clear recognition of the general meaning and essential ideas of messages of average complexity. 1.3 Logical connection between the various elements of the message.	
2 Understand the meaning of a written message.	2.1 Accurate identification of words and idiomatic expressions. 2.2 Clear recognition of the general meaning and essential ideas of messages of average complexity. 2.3 Logical connection between the various elements of the message.	
3 Express a simple message verbally, using sentences of average complexity.	3.1 Appropriate use of language structures in main or subordinate clauses. 3.2 Appropriate application of grammar rules. 3.3 Use of verbs in the present indicative. 3.4 Appropriate use of enriched basic vocabulary and idiomatic expressions. 3.5 Understandable pronunciation. 3.6 Coherent sequence of sentences of average complexity. 3.7 Conversation	
4 Write a text on a given subject, using sentences of average complexity.	4.1 Appropriate use of language structures in main or subordinate clauses. 4.2 Appropriate application of grammar rules. 4.3 Use of verbs in the present and past indicative. 4.4 Appropriate use of enriched basic vocabulary and idiomatic expressions. 4.5 Coherent sequence of sentences of average complexity. 4.6 Acceptable application of graphic rules for writing systems other than the Latin alphabet.	
LEARNING ACTIVITIES		
<b>Number of student-contact hours:</b>	45	
<b>Number of credits:</b>	2	



COMPLEMENTARY GENERAL EDUCATION COMPONENT: MODERN LANGUAGES CODE: 0067	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To communicate with relative ease in a modern language.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1 Understand the meaning of a verbal message in everyday language.</li> <li>2 Understand the meaning of a text of average complexity.</li> <li>3 Have a conversation on a subject.</li> <li>4 Write a text of average complexity.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Students will work alone.</li> <li>• They will have a conversation that includes at least 20 lines of dialogue.</li> <li>• They will write a text of medium length (at least 25 sentences for Latin-alphabet languages and 15 sentences for other languages).</li> <li>• They will use documents of a sociocultural nature. Reference materials for the written text may be used.</li> </ul> <p><b>Performance Criteria</b></p> <p>The acquisition of a modern language requires an awareness of the culture of the people who use the language.</p> <ol style="list-style-type: none"> <li>1.1 Accurate explanation of the general meaning and essential ideas of the message.</li> <li>1.2 Clear identification of structural elements of the language.</li> <li>2.1 Accurate explanation of the general meaning and essential ideas of the text.</li> <li>2.2 Clear identification of structural elements of the language.</li> <li>3.1 Appropriate use of the structural elements of the language according to the message to be expressed.</li> <li>3.2 Appropriate use of everyday vocabulary.</li> <li>3.3 Accurate pronunciation and intonation.</li> <li>3.4 Normal flow in a conversation in everyday language.</li> <li>3.5 Coherence of the message expressed.</li> <li>3.6 Pertinent responses to questions.</li> <li>4.1 Appropriate use of the structural elements of the language according to the text to be written.</li> <li>4.2 Accurate vocabulary.</li> <li>4.3 Coherence of the text as a whole.</li> <li>4.4 Observance of presentation and writing rules applicable to the text.</li> </ol>
LEARNING ACTIVITIES	
<b>Number of student-contact hours:</b>	45
<b>Number of credits:</b>	2

COMPLEMENTARY GENERAL EDUCATION COMPONENT: MATHEMATICS LITERACY AND COMPUTER SCIENCE		CODE: 0011
OBJECTIVE	STANDARD	
<b>Statement of the Competency</b>  To recognize the role of mathematics or informatics in contemporary society.  <b>Elements of the Competency</b>  1 Demonstrate the acquisition of basic general knowledge of mathematics or informatics.  2 Describe the evolution of mathematics or informatics.  3 Recognize the contribution of mathematics or informatics to the development of other areas of knowledge.  4 Illustrate the diversity of mathematical or informatics applications.  5 Evaluate the impact of mathematics or informatics on individuals and organizations.	<b>Achievement Context</b>  <ul style="list-style-type: none"><li>Students will work alone.</li><li>They will write an essay of approximately 750 words, using numerous concrete examples that they themselves will have selected.</li></ul> <b>Performance Criteria</b>  1.1 Identification of basic notions and concepts. 1.2 Identification of main branches of mathematics or informatics. 1.3 Appropriate use of terminology. 2.1 Descriptive summary of several major phases. 3.1 Demonstration of the existence of important contributions, using concrete examples. 4.1 Presentation of a range of applications in various areas of human activity, using concrete examples. 5.1 Identification of several major influences. 5.2 Explanation of the way in which mathematics or informatics have changed certain human and organizational realities. 5.3 Recognition of the advantages and disadvantages of these influences.	
LEARNING ACTIVITIES		
<b>Number of student-contact hours:</b> 45 <b>Number of credits:</b> 2		

COMPLEMENTARY GENERAL EDUCATION COMPENENT: MATHEMATICS LITERACY AND COMPUTER SCIENCE		CODE: 0012
OBJECTIVE	STANDARD	
<b>Statement of the Competency</b>  To use various mathematical or computer concepts, procedures and tools for common tasks.	<b>Achievement Context</b> <ul style="list-style-type: none"><li>• Students will work alone.</li><li>• They will carry out a task or solve a problem based on everyday needs.</li><li>• Familiar tools and reference materials may be used.</li></ul>	
<b>Elements of the Competency</b>  1 Demonstrate the acquisition of basic functional knowledge in mathematics or informatics.  2 Select mathematical or computer tools and procedures on the basis of specific needs.  3 Use mathematical or computer tools and procedures to carry out tasks and solve problems.  4 Interpret the quantitative data or results obtained using mathematical or computer tools and procedures.	<b>Performance Criteria</b>  1.1 Brief definition of concepts. 1.2 Correct execution of basic operations. 1.3 Appropriate use of terminology. 2.1 List of numerous possibilities available with mathematical and computer tools and procedures. 2.2 Analysis of concrete situations and recognition of the usefulness of mathematical or computer tools and procedures. 2.3 Appropriate choice according to needs. 3.1 Planned, methodical process. 3.2 Correct use of tools and procedures. 3.3 Satisfactory results, given the context. 3.4 Appropriate use of terminology specific to a tool or procedure. 4.1 Accurate interpretation, given the context. 4.2 Clear, precise formulation of the interpretation.	
LEARNING ACTIVITIES		
Number of student-contact hours: 45 Number of credits: 2		

COMPLEMENTARY GENERAL EDUCATION COMPONENT: ART AND AESTHETICS		CODE: 0013
OBJECTIVE	STANDARD	
<b>Statement of the Competency</b>  To consider various forms of art produced by aesthetic practices.  <b>Elements of the Competency</b>  1    Develop an appreciation for the dynamics of the imagination in art.  2    Describe art movements.  3    Give a commentary on a work of art.	<b>Achievement Context</b>  <ul style="list-style-type: none"><li>• Students will work alone.</li><li>• They will use a specified work of art and write a commentary of approximately 750 words.</li></ul> <b>Performance Criteria</b>  1.1   Precise explanation of a creative process connected to the construction of an imaginary universe.  2.1   Descriptive list of the main characteristics of three art movements from different eras, including a modern movement.  3.1   Coherent organization of observations, including identification of four fundamental elements of form and structure related to the language used as well as a justified description of the meaning of the work of art.	
LEARNING ACTIVITIES		
<b>Number of student-contact hours:</b>	45	
<b>Number of credits:</b>	2	





**OBJECTIVES AND STANDARDS –  
PROGRAM-SPECIFIC COMPONENT**

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CODE: 01DP	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To analyze the occupations.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>To compare the features of different types of laboratories.</li> <li>To describe the duties of the occupations and the context in which they are carried out.</li> <li>To examine the tasks associated with the occupations.</li> <li>To examine the skills and behaviours needed to perform the tasks of each occupation.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Using documentation on the occupations of biotechnology and analytical chemistry technologist: <ul style="list-style-type: none"> <li>general picture of the biological chemistry sector</li> <li>other documents on the occupations</li> </ul> </li> <li>Using documentation on the types of laboratories in Québec and on economic sectors.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>Appropriate summary of the main activities: <ul style="list-style-type: none"> <li>laboratories of manufacturing companies, mainly those in the pharmaceutical and agro-food sectors, research laboratories, environmental laboratories as well as laboratories belonging to public sector organizations and educational institutions</li> <li>laboratories belonging to biotechnology companies</li> <li>laboratories in the chemical, mining and petrochemical industries</li> </ul> </li> <li>Clear distinction of characteristics: <ul style="list-style-type: none"> <li>chemical analyses</li> <li>biochemical analyses</li> <li>microbiological analyses</li> <li>biological analyses</li> </ul> </li> <li>Clear definition of the duties of: <ul style="list-style-type: none"> <li>biotechnology laboratory technologists</li> <li>analytic chemistry laboratory technologists</li> </ul> </li> <li>Accurate description of the: <ul style="list-style-type: none"> <li>work environments</li> <li>working conditions</li> <li>types of work organization</li> </ul> </li> <li>Careful examination of each task.</li> <li>Precise assessment of the importance, frequency and complexity of the tasks, taking into account the characteristics of different work environments.</li> <li>Pertinent connections between capabilities and socioaffective behaviours, on the one hand, and the tasks of each occupation, on the other hand.</li> </ol>



CODE: 01E0

OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To maintain standards of quality.</p> <p><b>Elements of the Competency</b> 1. To perform activities related to quality assurance.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"><li>• Based on:<ul style="list-style-type: none"><li>– instructions</li><li>– protocols</li><li>– laws and regulations on health and safety in the workplace</li><li>– Workplace Hazardous Materials Information System (WHMIS)</li><li>– Good Laboratory Practices (GLP) or standards of the International Organization for Standardization (ISO)</li></ul></li><li>• Using:<ul style="list-style-type: none"><li>– protective clothing</li><li>– safety equipment</li><li>– first-aid equipment</li><li>– laboratory manual</li><li>– computer and appropriate software</li><li>– documentation required</li></ul></li><li>• In accordance with health and safety regulations.</li><li>• Demonstrating a sense of responsibility.</li></ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"><li>1.1 Complete collection of information on quality assurance systems.</li><li>1.2 Precise documentation of laboratory protocols in the laboratory manual.</li><li>1.3 Strict adherence to protocols and standard operating procedures.</li><li>1.4 Proper application of external or internal quality control procedures.</li><li>1.5 Correct validation of analytical methods, equipment and instruments.</li><li>1.6 Proper maintenance, verification and calibration of equipment and instruments.</li><li>1.7 Identification of any anomalies.</li><li>1.8 Clear determination of the traceability of products and samples.</li><li>1.9 Proper recording of:<ul style="list-style-type: none"><li>– calibration results</li><li>– quality control results</li><li>– maintenance controls</li><li>– test results</li><li>– deviations from protocols and procedures</li><li>– corrective actions taken</li></ul></li><li>1.10 Use of adequate data storage systems.</li></ol>

CODE: 01E0

2. To apply safe work practices.

2.1 Complete data collection from WHMIS safety data sheets.

2.2 Proper interpretation of laws governing health and safety in the workplace.

2.3 Proper evaluation of the risks of handling and storing:

- chemicals
- biological products

2.4 Observance of recommended hygiene practices and asepsis rules.

2.5 Adequate use of protective clothing and safety equipment.

2.6 Adequate control of physical risk.

2.7 Proper management of chemical, radioactive and biological materials according to level of health risk.

3. To react in emergency situations.

3.1 Application of appropriate first-aid in case of an accident.

3.2 Adherence to established protocols in case of:

- leaks or spills of infectious materials or dangerous chemicals
- fire

CODE: 01E1	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To prepare solutions.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To interpret the instructions.</li> <li>2. To prepare the material.</li> <li>3. To calculate the quantities of chemicals or solutions.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocols</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– chemicals required</li> <li>– appropriate equipment, such as analytical balances and a pH meter</li> <li>– required documentation, such as the <i>Handbook of Physics and Chemistry</i></li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Correct interpretation of the directions in the protocol regarding reagents.</li> <li>2.1 Appropriate choice of chemicals taking into account degree of purity.</li> <li>2.2 Appropriate choice of materials.</li> <li>3.1 Exact calculation of the quantity of chemicals or solutions according to: <ul style="list-style-type: none"> <li>– nature of the solute</li> <li>– solubility of the solute in the solvent</li> <li>– concentration of the stock solution</li> <li>– desired unit of concentration</li> <li>– type of solution prepared</li> <li>– solid or liquid state of the solute</li> <li>– density</li> </ul> </li> </ol>

CODE: 01E1

4. To perform operations associated with preparing the solutions.	<ul style="list-style-type: none"><li>4.1 Exact and precise weighing.</li><li>4.2 Proper choice of pipette, burette and graduated cylinder.</li><li>4.3 Proper and safe use of the pipette.</li><li>4.4 Proper verification of cleanliness of the equipment.</li><li>4.5 Appropriate heating.</li><li>4.6 Appropriate dilution.</li><li>4.7 Correct application of the technique for transferring a solution from one container to another.</li><li>4.8 Proper filtration of the solution.</li></ul>
5. To determine the concentration of calibration standards.	<ul style="list-style-type: none"><li>5.1 Proper choice of calibration method:<ul style="list-style-type: none"><li>- by a known concentration of a primary or secondary calibration standard</li><li>- by a known volume of another calibration standard</li></ul></li><li>5.2 Correct titration of the calibration standard.</li><li>5.3 Precise determination of the concentration of the calibration standard.</li></ul>
6. To label the container.	<ul style="list-style-type: none"><li>6.1 Proper choice of container.</li><li>6.2 Precise labelling in accordance with the standards of the laboratory.</li></ul>
7. To store the solutions.	<ul style="list-style-type: none"><li>7.1 Proper storage according to:<ul style="list-style-type: none"><li>- health and safety regulations</li><li>- storage conditions for the solution</li></ul></li></ul>

CODE: 01E2

OBJECTIVE	STANDARD
<b>Statement of the Competency</b> To asses data statistically.	<b>Achievement Context</b> <ul style="list-style-type: none"><li>• Based on:<ul style="list-style-type: none"><li>– instructions</li><li>– protocols</li></ul></li><li>• Using:<ul style="list-style-type: none"><li>– a calculator</li><li>– a computer and appropriate software</li><li>– required documentation</li></ul></li><li>• Paying close attention to precision and accuracy.</li></ul>
<b>Elements of the Competency</b> 1. To present the data.  2. To analyze the data.	<b>Performance Criteria</b> 1.1 Data organization. 1.2 Creation of an appropriate data distribution table. 1.3 Appropriate graphic presentation of the data.  2.1 Exact calculation of measures of central tendency. 2.2 Exact calculation of measures of dispersion. 2.3 Correct determination of the confidence interval: <ul style="list-style-type: none"><li>– when the standard deviation of the sample is a good approximation of the standard deviation of the population;</li><li>– when the standard deviation of the population is unknown.</li></ul> 2.4 Correct application of regression analysis of experimental results. 2.5 Proper determination of the: <ul style="list-style-type: none"><li>– slope</li><li>– intercept</li><li>– standard error of estimation</li><li>– standard error of slope</li><li>– standard error of intercept</li><li>– standard error of estimation of a point</li><li>– correlation coefficient</li></ul> 2.6 Appropriate graphic representation.

CODE: 01E2

3. To evaluate the results.

- 3.1 Correct assessment of accuracy and precision.
- 3.2 Proper distinction between random and systematic errors.
- 3.3 Appropriate measurement for a given set of data:
  - correlation between an experimental mean and its established value
  - correlation between two experimental means
  - correlation between the precision of two sets of data
- 3.4 Correct decision to reject a measurement.
- 3.5 Correct determination of target values for a control.
- 3.6 Proper comparison of two methods.

4. To use control charts.

- 4.1 Proper use of control charts.



CODE: 01E3	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To identify organic molecules.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Based on:             <ul style="list-style-type: none"> <li>instructions</li> <li>protocols</li> </ul> </li> <li>Using:             <ul style="list-style-type: none"> <li>samples</li> <li>chemicals required</li> <li>appropriate equipment, such as a freezing-point apparatus, boiling-point apparatus, refractometer, polarimeter and IR (infrared) spectrometer</li> <li>a computer and appropriate software</li> <li>documentation required, such as the <i>Handbook of Physics and Chemistry</i></li> </ul> </li> <li>Respecting:             <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying close attention to minute detail.</li> </ul>
<p><b>Elements of the Competency</b></p> <p>1. To purify the product.</p> <p>2. To determine the physical constants of the purified product.</p>	<p><b>Performance Criteria</b></p> <p>1.1 Appropriate filtration of the mixture.</p> <p>1.2 Proper decantation, extraction and washing.</p> <p>1.3 Correct distillation of the mixture.</p> <p>1.4 Correct recrystallization.</p> <p>1.5 Appropriate drying.</p> <p>1.6 Proper evaporation of the solvent.</p> <p>1.7 Proper separation by thin-layer, paper or column chromatography.</p> <p>2.1 Correct determination of the freezing or boiling point.</p> <p>2.2 Correct determination of the refractive index.</p> <p>2.3 Correct determination of optical activity, if required.</p> <p>2.4 Correct determination of density.</p>

CODE: 01E3

3. To determine the chemical properties of the product.

- 3.1 Correct identification of classes of reaction, such as substitution, addition and elimination.
- 3.2 Proper writing of equations.
- 3.3 Appropriate determination of the reaction mechanism in question.

4. To characterize organic molecules.

- 4.1 Adherence to the nomenclature regulations of the International Union of Pure and Applied Chemistry (IUPAC).
- 4.2 Correct visualization of the three-dimensional structure of the molecule.
- 4.3 Correct interpretation of an elemental analysis of carbon, hydrogen, oxygen and nitrogen.
- 4.4 Proper performance of qualitative tests to identify functional groups such as hydrocarbons, aromatic compounds, alkyl halides, saturated oxygen compounds, amines and heterocycles.
- 4.5 Correct interpretation of an IR spectrum.

CODE: 01E4	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To characterize biomolecules.</p> <p><b>Elements of the Competency</b> 1. To extract biomolecules.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocols</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>samples</li> <li>chemicals required</li> <li>materials for manual chromatography, equipment for performing electrophoresis on a support medium, UV/visible spectrophotometer, a refractometer and a polarimeter</li> <li>a computer and appropriate software</li> <li>documentation required</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying close attention to minute details.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Proper choice of extraction method.</p> <p>1.2 Correct extraction of proteins, carbohydrates and lipids from a complex biological or non-biological matrix, taking into account their physiochemical properties.</p>

CODE: 01E4

2. To separate biomolecules.	<p>2.1 Proper choice of separation method according to the required degree of purification.</p> <p>2.2 Correct separation of biomolecules by:</p> <ul style="list-style-type: none"><li>- exclusion chromatography</li><li>- thin-layer and column absorption chromatography</li><li>- ion-exchange resin chromatography</li><li>- electrophoresis on a support medium, taking into account their physiochemical characteristics</li></ul> <p>2.3 Correct verification of parameters that have been optimized, if necessary:</p> <ul style="list-style-type: none"><li>- the support</li><li>- volume of sample</li><li>- viscosity of sample</li><li>- flow rate</li><li>- pH</li><li>- ionic forces</li><li>- length of column</li></ul> <p>2.4 Proper differentiation of biomolecules, accounting for their biological activity:</p> <ul style="list-style-type: none"><li>- simple</li><li>- complex</li><li>- conjugated.</li></ul>
3. To assay biomolecules.	<p>3.1 Proper choice of assay method.</p> <p>3.2 Correct biomolecule assay according to reactivity.</p>
4. To detect an enzymatic reaction.	<p>4.1 Demonstraton of an enzymatic reaction, using appropriate tests.</p>

CODE: 01E5	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To detect microorganisms.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To examine the samples.</li> <li>2. To prepare sterile culture media.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocols</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– samples</li> <li>– reagents required</li> <li>– appropriate equipment, such as an autoclave, a bright-field microscope and magnifiers</li> <li>– required documentation</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– sterilization rules</li> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying close attention to minute detail.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Correct detection of prokaryotae.</li> <li>1.2 Correct distinction between fungi, protozoa and algae.</li> <li>1.3 Proper use of a bright-field microscope and a stereo microscope.</li> <li>2.1 Exact concentration calculations.</li> <li>2.2 Proper preparation of the culture medium.</li> <li>2.3 Exact pH reading.</li> <li>2.4 Proper and safe use of an autoclave.</li> <li>2.5 Appropriate storage of the culture medium.</li> </ol>

CODE: 01E5

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| 3. To identify microorganisms.                           | 3.1 Sterile plating.<br>3.2 Correct enumeration of the colonies.<br>3.3 Isolation of microorganisms in a pure culture.<br>3.4 Respect for optimal conditions favouring microorganism growth.<br>3.5 Morphological identification of the principal microorganisms by: <ul style="list-style-type: none"><li>- colony description</li><li>- colour differentials</li></ul> |
| 4. To evaluate the risks associated with microorganisms. | 3.6 Correct identification of cellular components of prokaryotae and eukaryotae.<br><br>4.1 Correct association between frequently encountered microorganisms and their potential risks.   |
| 5. To apply current methods to control microorganisms.   | 5.1 Proper choice of a physical or chemical method for controlling microorganisms.<br>5.2 Safe handling of contaminated material.<br>5.3 Proper management of contaminated material.<br>5.4 Appropriate emergency action in the case of exposure to microorganisms.  |

CODE: 01E6	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To manage chemicals and materials.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To keep an inventory of all chemicals and materials.</li> <li>2. To place orders.</li> <li>3. To receive shipments.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working as a technologist in a laboratory.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocols</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– a computer, inventory management software and the Internet</li> <li>– catalogues</li> <li>– order forms</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• In cooperation with company sales representatives.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Proper inventory management.</li> <li>1.2 Appropriate use of an inventory management system.</li> <li>2.1 Accurate determination of costs.</li> <li>2.2 Efficient information searches.</li> <li>2.3 Correct placement of orders.</li> <li>2.4 Respect for the allocated budget.</li> <li>3.1 Careful verification of the goods received versus the order.</li> <li>3.2 Proper choice of storage location and conditions.</li> <li>3.3 Appropriate labelling for materials.</li> <li>3.4 Correct entry of the order in the inventory management system.</li> </ol>





CODE: 01E7

OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To characterize anatomical and physiological information.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"><li>1. To identify anatomic tissues.</li><li>2. To differentiate between the organs.</li><li>3. To evaluate the factors contributing to homeostasis.</li></ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"><li>• Working as a technologist in a laboratory.</li><li>• Based on protocols.</li><li>• Using:<ul style="list-style-type: none"><li>– tissue and organ samples</li><li>– reagents required</li><li>– appropriate equipment and microscopes</li><li>– documentation required</li></ul></li><li>• In keeping with health and safety regulations.</li><li>• Demonstrating good observation, analysis and summarizing skills.</li></ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"><li>1.1 Proper choice of microscope.</li><li>1.2 Proper microscope use and maintenance.</li><li>1.3 Correct identification of cell components, based on proper use of stains.</li><li>1.4 Precise identification of tissues in a histological section.</li><li>2.1 Exact macroscopic identification of organs according to their anatomic characteristics.</li><li>2.2 Exact microscopic identification of organs according to their morphological and physiological characteristics.</li><li>2.3 Correct detection of functional anomalies of organ components.</li><li>3.1 Correct interpretation of homeostasis principles.</li><li>3.2 Proper distinction between the chemical, biochemical and physiological phenomena related to homeostasis.</li></ol>



CODE: 01E8	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To apply immunological techniques.</p> <p><b>Elements of the Competency</b> 1. To identify cells of the immune system.</p> <p>2. To manipulate variables associated with antigen-antibody reactions.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocols</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>biological samples</li> <li>reagents required</li> <li>appropriate equipment, such as a light microscope, fluorescence microscope, <i>Enzyme Linked Immunosorbant Assay</i> (ELISA) plate washer and reader, hemocytometer, flow cytometer, nephelometer and turbidometric equipment</li> <li>a computer and appropriate software</li> <li>documentation required</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying attention to precision, minute details and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Proper preparation of the sample: <ul style="list-style-type: none"> <li>fresh sample</li> <li>using a hemocytometer</li> <li>on a stained smear</li> </ul> </p> <p>1.2 Correct evaluation of the number of cells.</p> <p>1.3 Correct identification of cells according to their characteristics.</p> <p>2.1 Effective manipulation of variables influencing antigen-antibody reactions taking into account the particularities of antigens and immunoglobulins.</p>

CODE: 01E8

3. To identify antigens or antibodies.

- 3.1 Appropriate application of precipitation techniques:
- in a gel medium by immunodiffusion and immunoprecipitation.
  - in a liquid medium by nephelometry and turbidimetry.
- 3.2 Correct identification of antigens and antibodies using markers such as fluorochromes and enzymes.
- 3.3 Correct identification of antigen-antibody reactions using direct and indirect agglutination techniques.
- 3.4 Appropriate use of complement to detect antigen-antibody reactions.
- 3.5 Efficient application of the principle of neutralization to demonstrate antigen-antibody reactions.

4. To use antigens and antibodies, as reagents.

- 4.1 Qualitative or quantitative determination of antigens using polyclonal or monoclonal antibodies.
- 4.2 Qualitative or quantitative determination of antibodies using the appropriate antigens.

CODE: 01F1	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To apply molecular biology techniques.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a molecular biology laboratory.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocols</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>biological samples</li> <li>products required</li> <li>appropriate equipment, such as a high speed microcentrifuge, electrophoresis apparatus, PCR (DNA amplification) device, Polaroid camera, refrigerator, freezers (-30° and -80°) and sterilization equipment</li> <li>a computer and appropriate software</li> <li>documentation required</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>sterile conditions</li> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying attention to precision, minute details and efficiency.</li> </ul>
<p><b>Elements of the Competency</b></p> <p>1 To detect chromosomal anomalies in a karyotype.</p> <p>2. To extract DNA.</p>	<p><b>Performance Criteria</b></p> <p>1.1 Proper choice of method to identify the different stages of mitosis in chromosomes.</p> <p>1.2 Proper microscope use.</p> <p>1.3 Correct chromosome matching.</p> <p>1.4 Recognition of chromosomal anomalies.</p> <p>2.1 Correct preparation of reagents by: <ul style="list-style-type: none"> <li>precise calculation of concentrations</li> <li>proper use of stock solutions</li> <li>proper preservation of prepared media</li> </ul> </p> <p>2.2 Proper cell preparation.</p> <p>2.3 Correct use of calibrated micropipettes.</p> <p>2.4 Careful extraction of DNA taking into account its physicochemical characteristics.</p> <p>2.5 Appropriate DNA dephosphorylation and denaturation.</p>

CODE: 01F1	
3. To perform DNA hybridization.	3.1 Appropriate choice, labelling and preparation of probes. 3.2 Proper preparation of the DNA and restriction enzymes. 3.3 Proper DNA digestion by restriction enzymes. 3.4 Careful electrophoresis of the DNA in a gel medium. 3.5 Correct transfer of the DNA to a membrane using various methods. 3.6 Proper hybridization using probes. 3.7 Proper detection of the hybridization.
4. To perform DNA amplification.	4.1 Proper preparation of the DNA and amplification reagents. 4.2 Appropriate amplification of the DNA fragment. 4.3 Proper use of the PCR apparatus for identification. 4.4 Standard use and maintenance of the apparatus. 4.5 Proper interpretation of amplification results.

CODE: 01EA	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To identify microorganisms.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>To prepare the material.</li> <li>To culture microorganisms.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a microbiology laboratory.</li> <li>Based on:             <ul style="list-style-type: none"> <li>instructions</li> <li>protocols</li> </ul> </li> <li>Using:             <ul style="list-style-type: none"> <li>biological samples</li> <li>reagents required</li> <li>appropriate equipment, such as sterilization equipment, incubators, bright-phase and phase-contrast microscopes, stereo microscopes, refrigerator and freezer</li> <li>a computer and appropriate software</li> <li>documentation required</li> </ul> </li> <li>Respecting:             <ul style="list-style-type: none"> <li>sterile conditions</li> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying attention to precision, minute details and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Proper choice of culture medium.</li> <li>1.2 Appropriate preparation of culture media and broth.</li> <li>1.3 Proper choice of sterilization method for culture medium and equipment.</li> <li>1.4 Proper preparation of stains and reagents.</li> <li>1.5 Proper storage of:             <ul style="list-style-type: none"> <li>culture media</li> <li>stains</li> <li>reagents</li> </ul> </li> <li>2.1 Sterile isolation of microorganisms in a pure culture.</li> <li>2.2 Appropriate choice of optimal growth conditions for microorganisms taking into account their nutritional needs, metabolism and reproduction.</li> </ol>

CODE: 01EA	
3. To identify prokaryotic and eukaryotic microorganisms.	3.1 Detection of microbiological contaminants. 3.2 Exact identification of the species by: <ul style="list-style-type: none"> <li>- examining its morphological characteristics</li> <li>- performing biochemical tests on a macroscale</li> <li>- performing biochemical tests on a microscale</li> </ul> 3.3 Exact identification of the subspecies by: <ul style="list-style-type: none"> <li>- serological tests</li> <li>- fast acting detection kits</li> </ul> 3.4 Accurate verifications of identification, using appropriate software.
4. To maintain microorganism in culture.	4.1 Proper choice of culture preservation method. 4.2 Proper subculturing according to quality assurance standards. 4.3 Proper maintenance of microorganism in culture.
5. To decontaminate equipment and workspace.	5.1 Proper evaluation of the risks associated with handling microorganisms. 5.2 Correct application of decontamination and control methods. 5.3 Proper management of contaminated waste. 5.4 Appropriate emergency action in case of exposure to microorganisms.



CODE: 01DQ	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To use math tools necessary for analysis.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To apply exponential and logarithmic functions.</li> <li>2. To graph results.</li> <li>3. To apply trigonometric functions.</li> <li>4. To perform error and uncertainty calculations.</li> <li>5. To solve systems of linear equations.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Based on analysis protocols.</li> <li>• Using: <ul style="list-style-type: none"> <li>– a scientific calculator</li> <li>– a computer and software</li> <li>– graph paper</li> <li>– log and semi-log graph paper</li> </ul> </li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Correct application of functions.</li> <li>1.2 Correct graphic representation of functions.</li> <li>1.3 Proper interpretation of the relationship between the variables.</li> <li>1.4 Correct equation solutions.</li> <li>2.1 Correct representation of experimental results.</li> <li>2.2 Correct function linearization.</li> <li>2.3 Calculation of slope and intercept.</li> <li>2.4 Correct interpolation and extrapolation.</li> <li>3.1 Correct application of functions.</li> <li>3.2 Correct graphic representation of functions.</li> <li>3.3 Proper interpretation of the relationship between the variables.</li> <li>3.4 Correct equation solutions.</li> <li>4.1 Proper choice of the number of significant digits.</li> <li>4.2 Appropriate mathematical operations using significant digits in accordance with uncertainty propagation rules.</li> <li>4.3 Correct calculation of uncertainties in accordance with uncertainty propagation rules.</li> <li>5.1 Correct equation solving using the following methods: <ul style="list-style-type: none"> <li>– elimination and substitution</li> <li>– Gauss</li> <li>– Cramer</li> <li>– inverse matrices</li> </ul> </li> </ol>

CODE: 01DQ

6. To apply space vectors.

6.1 Proper representation of vectors in space.

6.2 Correct performance of space and plane vector operations.

7. To apply basic combination and probability analysis.

7.1 Proper application of the following concepts:

- probability
- chance event
- events and probability
- conditional probabilities and independence

8. To perform basic differential and integration calculations.

8.1 Correct application of derivatives and integrals to chemical calculations.

8.2 Proper graphical representation of a derivative and integral.

CODE: 01DR

OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To understand how the equipment operates.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"><li>1. To interpret the schematic for a piece of equipment.</li><li>2. To describe the operation of simple electric circuits.</li><li>3. To identify electronic components of equipment.</li></ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"><li>• Based on:<ul style="list-style-type: none"><li>– equipment schematics</li><li>– electronic circuit diagrams of the equipment</li></ul></li></ul> <p><b>Using:</b></p> <ul style="list-style-type: none"><li>– equipment required</li><li>– documentation required</li></ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"><li>1.1 Understanding of a manufacturer's manual written in English or French.</li><li>1.2 Understanding of the terminology.</li><li>1.3 Correct identification of equipment components.</li><li>2.1 Proper use of terminology and symbols.</li><li>2.2 Proper understanding of Ohm's and Kirchoff's laws and the concept of power.</li><li>2.3 Precise identification of circuit components:<ul style="list-style-type: none"><li>– alternating current</li><li>– direct current</li></ul></li><li>2.4 Clear definition of the function of each component.</li><li>3.1 Proper identification of the symbols used to represent electronic circuit components.</li><li>3.2 Correct circuit description.</li><li>3.3 Correct identification of the following components:<ul style="list-style-type: none"><li>– amplifiers</li><li>– oscillators</li><li>– semiconductors</li><li>– diodes</li><li>– transistors</li><li>– operational amplifiers</li></ul></li></ol>

CODE: 01DR

4. To explain the operation of the equipment's optical components.

4.1 Proper identification of the following optical components:

- mirrors
- prisms
- lenses
- polarizers
- colour filters

4.2 Exact description of radiation sources used in spectroscopic absorption and fluorescence, such as:

- black bodies
- arc lamps
- hollow-cathode lamps
- laser rays

4.3 Correct explanation of the operation of wave separators such as the following:

- filters
- networks
- interferometers

5. To establish links between the operation of the equipment and the main detectors used.

5.1 Correct explanation of the following operations:

- electronic detection
- radiation detection
- ion detection

CODE: 01DS	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To use general chemistry principles necessary for analysis interpretation.</p> <p><b>Elements of the Competency</b> 1. To characterize the states of the material.</p> <p>2. To make stoichiometric calculations.</p> <p>3. To solve chemical equilibrium problems.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Based on analysis protocols or standardized modes of operation.</li> <li>Using:             <ul style="list-style-type: none"> <li>a scientific calculator</li> <li>documentation</li> <li>a periodic table</li> <li>a computer</li> </ul> </li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Correct explanation of the periodic variation of elements such as:</p> <ul style="list-style-type: none"> <li>atomic radius</li> <li>ionic radius</li> <li>ionization energy</li> <li>electronegativity</li> <li>metallic character</li> <li>acidic and basic characteristic of oxides as a function of their electronic structure and their position in the periodic table</li> </ul> <p>1.2 Correct explanation of:</p> <ul style="list-style-type: none"> <li>ionic and covalent bonds</li> <li>geometry of a simple molecule</li> <li>intramolecular and intermolecular bonds</li> <li>phase changes</li> </ul> <p>1.3 Proper identification of the relationship between structure and the general properties of solids, liquids and gases.</p> <p>2.1 Correct application of stoichiometric laws to situations with or without a limiting reactant.</p> <p>3.1 Proper application of chemical equilibrium principles to the resolution of:</p> <ul style="list-style-type: none"> <li>equilibrium problems</li> <li>ionic equilibrium in aqueous solution</li> </ul> <p>3.2 Proper interpretation of acid-base titration and oxidation-reduction curves.</p>

CODE: 01DS

4. To explain the relationship of a chemical reaction rate and its use.

4.1 Clear explanation of the rate of a chemical reaction.

4.2 Clear explanation of the relationship between speed and:

- concentration
- temperature
- catalyst

4.3 Clear explanation of the reaction mechanism concept.

CODE: 01DT	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To interpret analysis protocols.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To interpret principles underlying the analysis.</li> <li>2. To describe the required equipment.</li> <li>3. To describe the method for preparing reagents.</li> <li>4. To explain the operating method.</li> <li>5. To understand the meaning of the parameters of the equation used to calculate results.</li> <li>6. To summarize the instructions concerning quality control and the interpretation of results.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Carried out at the beginning of each chemical or biochemical analysis.</li> <li>• Based on analysis protocols.</li> <li>• Using documentation written in English or French.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Proper understanding of the terminology.</li> <li>1.2 Clear explanation of the principles in question.</li> <li>1.3 Correct interpretation of problems caused by interferences.</li> <li>2.1 Proper description of the features of the equipment and accessories required for the analyses.</li> <li>3.1 Proper description of the reagent preparation method.</li> <li>3.2 Proper verification of concentration calculations.</li> <li>4.1 Clear and correct explanation of the operating method.</li> <li>4.2 Clear explanation of the data processing method.</li> <li>5.1 Correct interpretation of the equation.</li> <li>6.1 Complete summary of the instructions concerning quality control.</li> <li>6.2 Correct interpretation of: <ul style="list-style-type: none"> <li>- graphs</li> <li>- tables</li> </ul> </li> <li>6.3 Clear explanation of the method of interpretation of the results.</li> </ol>





CODE: 01DU	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To collect samples.</p> <p><b>Elements of the Competency</b> 1. To plan the sample collection activity.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in the field or on company premises. Samples are collected under sterile and non-sterile conditions.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocol of analysis or standard methods</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>sterile and non-sterile material required</li> <li>appropriate equipment, such as an air sampler with variable porosity filters, water sampler, soil sampler and explosion-proof refrigerator</li> <li>a computer and appropriate software</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>any necessary sterilization rules</li> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP)</li> <li>various ministerial standards</li> </ul> </li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Correct interpretation of received instructions and protocols.</li> <li>1.2 Proper choice of sampling method based on the physiochemical and biological characteristics of the sample and the available analysis methods.</li> <li>1.3 In-depth planning of the sample collecting activity: <ul style="list-style-type: none"> <li>preliminary visit to the location</li> <li>sample collection method</li> <li>types of samples</li> <li>quality control</li> </ul> </li> <li>1.4 Respect for statistical constraints.</li> <li>1.5 Correct evaluation of the risks associated with the presence of toxic, chemical, radioactive or biological contaminants as well as other risks presented by the collection site.</li> </ol>

CODE: 01DU

2. To prepare the material.

- 2.1 Proper choice of containers.
- 2.2 Precise calibration of the container.
- 2.3 Proper washing and sterilization of equipment and containers according to protocols and standard methods.
- 2.4 Proper labelling of containers.

3. To collect the sample.

- 3.1 Proper sample collection based on sterilization and environmental constraints as well as health and safety risks.
- 3.2 Use of field forms.
- 3.3 Collection of duplicate samples.
- 3.4 Precise identification of the sample.
- 3.5 Appropriate quality control.
- 3.6 Appropriately sealed containers.
- 3.7 Complete record of data.
- 3.8 Any necessary verification of the degree to which the laboratory sample is representative of the raw sample.

4. To preserve the sample.

- 4.1 Respect for:
  - period of preservation
  - preservation conditions

CODE: 01DV	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To take physiochemical measurements.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To understand the instructions.</li> <li>2. To prepare the reagents.</li> <li>3. To prepare the instruments.</li> <li>4. To apply the protocol.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in a quality control laboratory.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocol of analysis or standard methods</li> <li>– operational modes of the equipment</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– samples</li> <li>– chemicals required</li> <li>– appropriate instruments, such as a tensiometer, viscosimeter, conductivity measuring instrument, calorimeter, nephelometer and multimeter</li> <li>– documentation written in English or French</li> <li>– a computer and appropriate software</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Correct understanding of the documentation: <ul style="list-style-type: none"> <li>– standardized analysis protocol or standard method</li> <li>– operational procedures for instruments</li> </ul> </li> <li>2.1 Proper choice of chemicals.</li> <li>2.2 Appropriate solution concentrations.</li> <li>3.1 Correct installation of accessories.</li> <li>3.2 Proper parameter adjustment according to the type of instrument.</li> <li>4.1 Proper application of the protocol for measuring viscosity, surface tension, conductivity, turbidity, voltage, heat of reaction, vapour pressure, partition coefficient, absorption, solubility, freezing point, boiling point, density, specific gravity and molar weight.</li> </ol>

CODE: 01DV

5. To interpret the results.

5.1 Proper determination of accuracy and precision of results.

5.2 Proper comparison of the results with the accepted standards.

5.3 Appropriate statistical treatment of the results.

6. To submit the results.

6.1 Observance of rules for keeping a laboratory notebook.

6.2 Submission of results according to company standards.

6.3 Correct evaluation of the reliability of the results.

7. To maintain the instruments.

7.1 Maintenance in accordance with manufacturer's standards.

7.2 Instrument verification.

CODE: 01DW	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To take electrometric measurements.</p> <p><b>Elements of the Competency</b> 1. To interpret the instructions.  2. To prepare the reagents.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a quality control laboratory of a pharmaceutical, agro-food company or environmental agency.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocol of analysis or standard methods</li> <li>operating instructions for equipment</li> </ul> </li> <li>With samples having undergone any necessary preliminary preparations.</li> <li>Using: <ul style="list-style-type: none"> <li>chemicals required</li> <li>appropriate equipment, such as ion-specific and specialized electrodes, automatic titrator, coulometric Karl Fischer titrator, pH-meter and ion meter</li> <li>a computer and appropriate software</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b> 1.1 Proper understanding of the documentation: <ul style="list-style-type: none"> <li>analysis protocol or standard method</li> <li>operational mode of the equipment</li> </ul> 2.1 Proper choice of chemicals. 2.2 Appropriate solution concentrations.</p>

CODE: 01DW

3. To prepare the equipment.	<p>3.1 Proper choice of electrode according to the type and nature of the sample.</p> <p>3.2 Proper calibration of the electrode.</p> <p>3.3 Proper preparation of the:</p> <ul style="list-style-type: none"><li>- ion meter</li><li>- automatic titrator</li><li>- coulometric Karl Fischer titrator</li></ul> <p>3.4 If necessary, program the functions in accordance with the type of equipment and nature of the sample.</p>
4. To perform the analyses.	<p>4.1 Exact assay of the ionic concentration taking into account limitations due to electrochemical reactions.</p> <p>4.2 Proper use of the Karl Fischer titrator.</p>
5. To interpret the results.	<p>5.1 Precise determination of the concentration.</p> <p>5.2 Correct determination of the accuracy and precision of the results.</p> <p>5.3 Verification of the results in terms of prescribed quality standards.</p> <p>5.4 Appropriate statistical treatment of results.</p>
6. To submit the results.	<p>6.1 Observance of rules for keeping a laboratory notebook.</p> <p>6.2 Submission of results according to company standards.</p> <p>6.3 Proper evaluation of the reliability of the results.</p>
7. To maintain the equipment and electrodes.	<p>7.1 Maintenance in accordance with manufacturer's standards.</p> <p>7.2 Verification of the equipment and electrodes.</p>

CODE: 01DX	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To perform organic and biochemical analyses using capillary electrophoresis.</p> <p><b>Elements of the Competency</b></p> <p>1. To interpret the instructions.</p> <p>2. To prepare reagents.</p> <p>3. To prepare fresh samples.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a quality control laboratory of a pharmaceutical, agro-food company or environmental agency.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocol of analysis or standard methods</li> <li>operational modes of the equipment</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>samples, having undergone an initial preparation</li> <li>chemicals and equipment required</li> <li>appropriate equipment, such as a capillary electrophoresis instrument</li> <li>a computer and appropriate software</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying attention to precision, minute details and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Proper understanding of the documentation: <ul style="list-style-type: none"> <li>analysis protocol or standard methods</li> <li>operational mode of the equipment</li> </ul> </p> <p>2.1 Proper choice of chemicals and migration media according to electrophoretic mobility and the electroosmotic flux of the solutes.</p> <p>2.2 Appropriate solution concentrations.</p> <p>2.3 Proper preservation of: <ul style="list-style-type: none"> <li>solutions</li> <li>electrolytes</li> <li>migration media</li> </ul> </p> <p>3.1 Proper correction of the last matrix interferences, if necessary.</p> <p>3.2 Proper application of preparation techniques.</p>

CODE: 01DX	
4. To prepare the capillary electrophoresis equipment.	<p>4.1 Proper choice of:</p> <ul style="list-style-type: none"> <li>- capillary</li> <li>- screening medium for the capillary, if necessary</li> <li>- detector</li> </ul> <p>4.2 Correct installation of equipment components.</p> <p>4.3 Correct verification of equipment components:</p> <ul style="list-style-type: none"> <li>- sample platform</li> <li>- detection system</li> <li>- column thermostat</li> <li>- capillary</li> </ul> <p>4.4 Correct adjustment of:</p> <ul style="list-style-type: none"> <li>- applied voltage</li> <li>- temperature</li> <li>- pressure</li> <li>- detector</li> <li>- voltage gradient, if necessary</li> <li>- injection conditions</li> <li>- quantity of any necessary additives according to the type of equipment and nature of the sample</li> </ul> <p>4.5 Appropriate use of parameter control software.</p>
5. To carry out the analysis protocol.	<p>5.1 Proper optimization of analysis parameters.</p> <p>5.2 Proper achievement of an electropherogram.</p> <p>5.3 Proper application of the protocol to produce a calibration curve.</p> <p>5.4 Proper performance of quality control operations.</p> <p>5.5 Equipment shutdown according to proper procedures.</p>
6. To interpret the results.	<p>6.1 Positive identification of components in the electropherogram.</p> <p>6.2 Precise determination of analyte concentration.</p> <p>6.3 Correct comparison of results against the standards.</p> <p>6.4 Appropriate statistical treatment of results.</p>
7. To submit the results.	<p>7.1 Observance of rules for keeping a laboratory notebook.</p> <p>7.2 Transmission according to company standards.</p> <p>7.3 Evaluation of the reliability of the results.</p>



CODE: 01DX	
8. To maintain the capillary electrophoresis equipment.	<p>8.1 Performance of maintenance and minor repairs of the capillary electrophoresis equipment according to the manufacturer's standards.</p> <p>8.2 Proper verification of the column and equipment.</p> <p>8.3 Adherence to quality assurance standards.</p>



CODE: 01DY	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To perform organic chemistry and biochemistry analysis using molecular spectrometry.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To interpret the instructions.</li> <li>2. To prepare the reagents.</li> <li>3. To prepare a fresh sample.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in a quality control laboratory of a pharmaceutical or agro-food company or an environmental agency.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocol of analysis or standard methods</li> <li>– operational modes of the equipment</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– samples, having undergone an initial preparation</li> <li>– chemicals required</li> <li>– appropriate instruments, such as an ultraviolet and visible spectrophotometer, IR spectrophotometer and spectrofluorimeter</li> <li>– a computer and appropriate software</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Proper understanding of the documentation: <ul style="list-style-type: none"> <li>– analysis protocol or standard method</li> <li>– operational mode of the equipment</li> </ul> </li> <li>2.1 Proper choice of chemicals.</li> <li>2.2 Appropriate solution concentrations.</li> <li>2.3 Proper preservation of solutions.</li> <li>3.1 Proper correction of the last matrix interferences, if necessary.</li> <li>3.2 Proper application of preparation techniques.</li> <li>3.3 Sample homogeneity.</li> </ol>

CODE: 01DY

4. To prepare the spectrometer.	<ul style="list-style-type: none"><li>4.1 Proper choice of cells and accessories according to the type of equipment and the nature of the sample.</li><li>4.2 Correct installation of accessories.</li><li>4.3 Proper and safe verification of components:<ul style="list-style-type: none"><li>- lamp</li><li>- detectors</li><li>- optic devices</li></ul></li><li>4.4 Proper adjustment of parameters for the following devices:<ul style="list-style-type: none"><li>- IR spectrophotometer</li><li>- UV-visible spectrophotometer or spectrofluorimeter</li></ul></li><li>4.5 Appropriate use of parameter control software.</li></ul>
5. To apply the analysis protocol.	<ul style="list-style-type: none"><li>5.1 Proper optimization of analysis parameters.</li><li>5.2 Searching for the best excitation/emission wavelength couple for the fluorimeter or the absorption wavelength for the UV-visible spectrophotometer.</li><li>5.3 Proper application of the protocol for obtaining:<ul style="list-style-type: none"><li>- a calibration curve</li><li>- an IR spectrum</li></ul></li><li>5.4 Proper performance of quality control operations.</li><li>5.5 Equipment shutdown according to proper procedures.</li></ul>
6. To interpret the results.	<ul style="list-style-type: none"><li>6.1 Positive identification of components by consulting the spectral library.</li><li>6.2 Precise determination of analyte concentration.</li><li>6.3 Correct comparison of results against the standards.</li><li>6.4 Appropriate statistical treatment of results.</li></ul>
7. To submit the results.	<ul style="list-style-type: none"><li>7.1 Observance of rules for keeping a laboratory notebook.</li><li>7.2 Submission of results according to company standards.</li><li>7.3 Evaluation of the reliability of the results.</li></ul>

CODE: 01DY	
8. To maintain the molecular spectrometry device.	8.1 Performance of maintenance and minor repairs of the equipment according to the manufacturer's standards. 8.2 Proper equipment verification. 8.3 Proper maintenance of the cells. 8.4 Adherence to quality assurance standards.



CODE: 01DZ

OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To perform organic chemistry and biochemistry analyses using instrumental chromatography.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"><li>• Working in a quality control laboratory of a pharmaceutical or agro-food company or an environmental agency.</li><li>• Based on:<ul style="list-style-type: none"><li>– instructions</li><li>– analysis protocols or standard methods</li><li>– operating instructions for equipment</li></ul></li><li>• Using:<ul style="list-style-type: none"><li>– samples, having undergone an initial preparation</li><li>– chemicals required</li><li>– gaseous-phase chromatograph, liquid and high-performance liquid chromatograph, ionic chromatograph, gas chromatograph or liquid chromatograph coupled with a mass spectrometer detector</li><li>– a computer and appropriate software</li><li>– documentation written in English or French</li></ul></li><li>• Respecting:<ul style="list-style-type: none"><li>– health and safety regulations</li><li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li></ul></li><li>• Paying attention to precision, minute details and efficiency.</li></ul>
<p><b>Elements of the Competency</b></p> <p>1. To interpret the instructions.</p> <p>2. To prepare the reagents.</p> <p>3. To prepare fresh samples.</p>	<p><b>Performance Criteria</b></p> <p>1.1 Proper understanding of the documentation:<ul style="list-style-type: none"><li>– analysis protocol or standard method</li><li>– operating instructions for equipment</li></ul></p> <p>2.1 Proper choice of:<ul style="list-style-type: none"><li>– chemicals</li><li>– mobile phases</li></ul></p> <p>2.2 Appropriate solution concentrations.</p> <p>2.3 Proper preservation of solutions.</p> <p>3.1 Proper correction in a matrix interference, if necessary.</p> <p>3.2 Proper application of preparation techniques.</p>

CODE: 01DZ

4. To prepare the chromatographic instrument.	<p>4.1 Proper choice of:</p> <ul style="list-style-type: none"><li>- pump</li><li>- injector</li><li>- column</li><li>- mobile and stationary phases</li><li>- detector</li><li>- according to the separation performed.</li></ul> <p>4.2 Correct installation of components.</p> <p>4.3 Proper and safe verification of the operation of components such as the:</p> <ul style="list-style-type: none"><li>- injector</li><li>- column</li><li>- detector or the mass spectrometer detector</li><li>- gases, if appropriate</li></ul> <p>4.4 Proper adjustment of:</p> <ul style="list-style-type: none"><li>- balance gas flow rate or the mobile phase</li><li>- temperature or temperature program</li><li>- injection mode</li><li>- injection volume</li><li>- any appropriate concentration gradients</li><li>- according to the type of equipment and the nature of the sample</li></ul> <p>4.5 Proper calibration of the detector.</p> <p>4.6 Proper use of any necessary mass spectrum acquisition modes.</p> <p>4.7 Appropriate use of parameter control software.</p>
5. To apply the analysis protocol.	<p>5.1 Proper optimization of analysis parameters.</p> <p>5.2 Chromatogram obtained.</p> <p>5.3 Proper performance of quality control operations.</p> <p>5.4 Equipment shutdown according to proper procedures.</p>
6. To interpret the results.	<p>6.1 Positive identification of chromatograph peaks.</p> <p>6.2 Correct interpretation of the mass spectrum, if appropriate.</p> <p>6.3 Precise determination of analyte concentrations.</p> <p>6.4 Correct comparison of results against the standards.</p> <p>6.5 Appropriate statistical treatment of results.</p>



CODE: 01DZ	
7. To submit the results.	7.1 Observance of rules for keeping a laboratory notebook. 7.2 Submission according to company standards. 7.3 Evaluation of result reliability.
8. To maintain the chromatographic instrument.	8.1 Performance of maintenance and minor repairs of chromatography device according to the manufacturer's standards. 8.2 Correct verification of the column and equipment. 8.3 Proper storage of the columns and accessories. 8.4 Adherence to quality assurance standards.



CODE: 01EB	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To use laboratory animals.</p> <p><b>Elements of the Competency</b> 1. To take care of the animal.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in an animal facility or laboratory.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocols</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– laboratory animals</li> <li>– products and equipment required for working with animals</li> <li>– appropriate equipment: a laminar flow hood, impregnation and embedding device, microtome and cryomicrotome knife, staining device, incubator and microscope equipped for image analysis and photography</li> <li>– documentation required</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP)</li> </ul> </li> <li>• Proper care and handling of laboratory animals.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Safe handling of the animal.</p> <p>1.2 Proper care of the animal according to:</p> <ul style="list-style-type: none"> <li>– its need for food and water</li> <li>– required environmental conditions</li> </ul> <p>1.3 Proper detection of a health or behaviour problem in the animal.</p>

CODE: 01EB

2. To collect samples.	<p>2.1 Proper preparation of:</p> <ul style="list-style-type: none"><li>- materials</li><li>- fixation and preservation reagents</li><li>- stains</li></ul> <p>2.2 Proper application of euthanasia techniques.</p> <p>2.3 Precise dosage of anesthetic according to respiratory and cardiovascular physiology.</p> <p>2.4 Proper restraint of the animal when giving an injection or collecting a sample.</p> <p>2.5 Precise injection of a product.</p> <p>2.6 Proper collection of a blood sample.</p> <p>2.7 Sterile or non-sterile collection of organ and samples.</p> <p>2.8 Respect for preservation conditions in general and sample preservation specifically.</p>
3. To prepare samples.	<p>3.1 Proper preparation of the sample for cell culture.</p> <p>3.2 Correct impregnation and embedding of the sample.</p> <p>3.3 Proper preparation of the microtome or cryomicrotome knife.</p> <p>3.4 Precise slicing of sample using a microtome or cryomicrotome knife.</p> <p>3.5 Proper staining of tissue sections.</p> <p>3.6 Proper quality control.</p> <p>3.7 Proper analysis of tissue sections.</p>
4. To make physiological measurements of the animal.	<p>4.1 Proper measure of physiological parameters.</p>
5. To maintain the work area.	<p>5.1 Proper cleaning of equipment and work environment.</p> <p>5.2 Safe disposal of waste.</p> <p>5.3 Proper elimination of carcasses.</p> <p>5.4 Observance of animal facilities hygiene rules.</p>

CODE: 01EC	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To culture animal cells.</p> <p><b>Elements of the Competency</b> 1. To choose culture media.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a tissue or cell culture laboratory, in a context requiring the use or production of animal cells.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocols</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>animal-tissue or cell samples</li> <li>products required</li> <li>appropriate equipment: a vertical and horizontal laminar flow hood, CO<sub>2</sub> incubator, inverted bright field or fluorescence microscope with monitor and camera, sterilization equipment, PCR (DNA amplification) device, plate reader with built-in analyzer and a refrigerated centrifuge</li> <li>required documentation</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>sterile conditions</li> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Proper choice of culture media according to the type of animal cells and their nutritional needs.</p> <p>1.2 Proper choice of:</p> <ul style="list-style-type: none"> <li>serums</li> <li>growth factors</li> </ul> <p>according to nutritional needs and the stability of the ingredients.</p> <p>1.3 Proper choice of antibiotics according to their stability and the microbiological contaminants.</p>

CODE: 01EC

2. To prepare the material.	<ul style="list-style-type: none"><li>2.1 Precise calculation of concentrations.</li><li>2.2 Correct preparation and verification of sera by:<ul style="list-style-type: none"><li>- heat denaturation of complement</li><li>- search for mycoplasmas by PCR (polymerization chain reaction)</li></ul></li><li>2.3 Absence of toxic residues in the reagent water.</li><li>2.4 Proper preparation of stock solutions, culture media and reagents.</li><li>2.5 Equipment sterilization:<ul style="list-style-type: none"><li>- autoclave</li><li>- membrane filtration</li></ul></li><li>2.6 Respect for preservation constraints.</li></ul>
3. To prepare animal cell cultures.	<ul style="list-style-type: none"><li>3.1 Sterile organ collection.</li><li>3.2 Proper preparation of a sterile cell suspension.</li><li>3.3 Proper seeding.</li><li>3.4 Respect for optimal growth, maintenance and preservation conditions.</li></ul>
4. To maintain animal cell cultures.	<ul style="list-style-type: none"><li>4.1 Careful establishment of a cell line from a primary culture.</li><li>4.2 Careful analysis of the health of a cell culture.</li><li>4.3 Precise determination of the viability of the cells and their number.</li><li>4.4 Precise determination of maintenance and preservation conditions for anchorage dependent and anchorage independent cells.</li><li>4.5 Correct decision with regard to cloning the cells.</li><li>4.6 Proper troubleshooting of tissue culture problems.</li></ul>

CODE: 01ED	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To culture plant cells.</p> <p><b>Elements of the Competency</b> 1. To choose the culture media.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a cell culture laboratory, in a context requiring the use or production of plant cells.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocols</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>plant tissue or cell samples</li> <li>products required</li> <li>appropriate equipment: horizontal laminar flow hood, incubator, bright-field microscope, fluorescence microscope with monitor and camera, sterilization equipment, refrigerated centrifuge and a temperature-, light- and humidity-controlled chamber</li> <li>documentation required</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>sterile conditions</li> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Proper choice of basic culture media according to the type of plant cells and their nutritional needs.</p> <p>1.2 Proper choice of phytohormones according to their stability and callus formation or organogenesis objectives.</p> <p>1.3 Proper choice of solid supports according to their degree of purity.</p>

CODE: 01ED	
2. To maintain a plant.	<p>2.1 Proper determination of:</p> <ul style="list-style-type: none"> <li>- phytohormones</li> <li>- photoperiodicity</li> <li>- fertilizers</li> <li>- watering schedule</li> <li>- environmental conditions favourable for optimal growth and flowering</li> </ul> <p>2.2 Proper pruning according to its growth pattern.</p> <p>2.3 Proper seed selection and preservation.</p> <p>2.4 Correct detection of a plant's health problem.</p>
3. To prepare the material.	<p>3.1 Absence of toxic residues in the materials and reagent water.</p> <p>3.2 Precise calculation of concentrations of solutions and culture media.</p> <p>3.3 Proper preparation of solutions and culture media.</p> <p>3.4 Equipment sterilization:</p> <ul style="list-style-type: none"> <li>- autoclave</li> <li>- membrane filtration</li> </ul> <p>3.5 Respect for preservation constraints.</p>
4. To prepare plant cell cultures.	<p>4.1 Proper taking of an explant from a healthy plant.</p> <p>4.2 Proper sterilization of the explant or seeds.</p> <p>4.3 Any appropriate preparation and dissection of:</p> <ul style="list-style-type: none"> <li>- explant</li> <li>- protoplasts</li> <li>- recombinant cells</li> </ul> <p>4.4 Proper seeding in appropriate media.</p> <p>4.5 Respect for optimal growth conditions.</p>
5. To maintain plant cell cultures.	<p>5.1 Determination of optimal conditions for:</p> <ul style="list-style-type: none"> <li>- explant induction and multiplication</li> <li>- rooting and acclimatizing the plantlet</li> </ul> <p>5.2 Correct determination of the optimal conditions for maintenance in a liquid or semi-solid medium for:</p> <ul style="list-style-type: none"> <li>- protoplasts</li> <li>- somatic embryos</li> </ul> <p>5.3 Careful analysis of the health of a cell culture and a plantlet.</p> <p>5.4 Proper troubleshooting of tissue culture problems.</p>



CODE: 01EE	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To perform applied immunological analyses.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in a research or quality control laboratory of a pharmaceutical, agro-food or biotechnology company.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocols or standard methods</li> </ul> </li> <li>• With samples from: <ul style="list-style-type: none"> <li>– cells</li> <li>– laboratory animals</li> <li>– other sources</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– products required</li> <li>– appropriate equipment: <i>Enzyme Linked Immuno Sorbent Assay</i> (ELISA) plate reader, <i>Fluorescent Polarized Immuno Assay</i> (FPIA) and <i>Luminescent Immuno Assay</i> (LIA) readers, cytofluorometer, microtome and cryomicrotome knives, CO<sub>2</sub> incubator, laminar flow hoods, refrigerated centrifuge, -80°C freezer, bright-field and fluorescence microscopes and electrophoresis apparatus</li> <li>– computer, appropriate software and the Internet</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– sterile conditions</li> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying attention to precision, minute detail and efficiency.</li> <li>• Appropriate treatment and handling of laboratory animals.</li> </ul>

CODE: 01EE

Elements of the Competency	Performance Criteria
1. To plan the work.	1.1 Correct interpretation of the directions received as well as of the protocol or standard methods. 1.2 Search for pertinent information using appropriate tools. 1.3 Realistic and efficient work planning taking into account the limitations associated with laboratory animals, cell cultures and product stability.
2. To prepare the material.	2.1 Proper choice of: <ul style="list-style-type: none"><li>- equipment</li><li>- solutions and reagents</li><li>- culture media</li></ul> 2.2 Proper preparation of equipment and culture media. 2.3 Proper choice of sterilization method. 2.4 Proper preservation and storage of equipment and culture media. 2.5 Proper preparation of animals, cells or microorganisms.
3. To prepare the sample.	3.1 Proper choice of sample-taking method. 3.2 Proper sample preparation.
4. To produce antibodies.	4.1 Appropriate antigen purification and preparation. 4.2 Proper production of polyclonal antibodies according to requirements associated with immune response. 4.3 Proper production of monoclonal antibodies: <ul style="list-style-type: none"><li>- precise injection of the antigen</li><li>- appropriate lymphoblastic cell cultures</li><li>- sterile organ collection</li><li>- proper cell fusion</li><li>- proper preparation of hybridoma cultures</li><li>- correct hybridoma cloning</li><li>- proper harvesting and preservation of monoclonal antibodies</li></ul> 4.4 Purification of the antibodies.

CODE: 01EE

5. To detect and analyze antigens and antibodies.	<ul style="list-style-type: none"><li>5.1 Precise antigen and antibody detection and assay using techniques including immunoelectrophoresis, Western blotting, immunofluorescence and ELISA, FPIA and LIA tests.</li><li>5.2 Observance of health and safety regulations dealing with <i>Radio Immuno Assay</i> (RIA).</li><li>5.3 Appropriate isolation of specialized cells.</li><li>5.4 Precise detection of cellular receptors.</li><li>5.5 Proper detection of tissue antigens in a microtome or cryomicrotome section using immunohistochemical or immunoenzymologic techniques.</li></ul>
6. To analyze the results.	<ul style="list-style-type: none"><li>6.1 Precise reading of the results.</li><li>6.2 Proper validation of the results according to the standards.</li><li>6.3 Exact mathematical and statistical analysis of the results using appropriate software.</li></ul>
7. To produce a report.	<ul style="list-style-type: none"><li>7.1 Correct entry of data into the computer.</li><li>7.2 Data presentation using tables and graphs.</li><li>7.3 Complete, clear and concise report.</li><li>7.4 Clarity of oral presentation.</li></ul>
8. To maintain the work environment.	<ul style="list-style-type: none"><li>8.1 Safe cleaning and decontamination of equipment and work environment.</li><li>8.2 Maintenance, calibration and minor repair of the equipment according to manufacturer's and quality assurance standards.</li><li>8.3 Safe disposal of waste.</li></ul>



CODE: 0IEF	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To perform toxicological and ecotoxicological analyses.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in a research or quality control laboratory of a pharmaceutical, agro-food company, environmental agency or biotechnology company.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– clients' requests</li> <li>– protocols or standard methods</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– samples</li> <li>– products required</li> <li>– equipment required for culture or maintenance of cells or living organisms</li> <li>– appropriate equipment: chromatographs, spectrometers, visible light and fluorescence plate readers with built-in analysis systems</li> <li>– computer, appropriate software and the Internet</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– sterile conditions</li> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying attention to precision, minute details and efficiency.</li> <li>• Appropriate treatment and handling of laboratory animals.</li> </ul>
<p><b>Elements of the Competency</b></p> <p>1. To plan the work.</p>	<p><b>Performance Criteria</b></p> <p>1.1 Proper interpretation of the received instructions, protocol, or standard operating procedure.</p> <p>1.2 Search for pertinent information using appropriate tools.</p> <p>1.3 Realistic and efficient work plan that takes into account the constraints of working with living organisms and biological samples.</p>

CODE: 0IEF	
2. To prepare the material.	<p>2.1 Proper choice of:</p> <ul style="list-style-type: none"> <li>- glassware and accessories</li> <li>- solutions and reagents</li> <li>- culture media</li> </ul> <p>2.2 Proper preparation and sterilization of the equipment taking into account the stability of the products.</p> <p>2.3 Proper choice of sterilization method.</p> <p>2.4 Proper preparation of animals, cells or microorganisms according to their metabolic requirements.</p> <p>2.5 Proper equipment preparation.</p>
3. To prepare the sample.	<p>3.1 Exact calculation of the concentration of the test compound according to the animal's physiology and cellular metabolism.</p> <p>3.2 Careful preparation of the test compound according to the source of the sample, associated risks and toxicity.</p> <p>3.3 Proper preservation of the activity of the test compound.</p>
4. To determine the sample's toxicity or ecotoxicity.	<p>4.1 Careful <i>in vivo</i> analysis of the genotoxicity index and the metabolic impact</p> <ul style="list-style-type: none"> <li>- taking into account the product's pharmacology and the animal's physiology.</li> </ul> <p>4.2 Careful <i>in vitro</i> analysis of:</p> <ul style="list-style-type: none"> <li>- cytotoxicity</li> <li>- genotoxicity</li> <li>- apoptosis</li> </ul> <p>4.3 Exact determination of:</p> <ul style="list-style-type: none"> <li>- the 50% lethal concentration (LC50)</li> <li>- the 50% inhibiting concentration (IC50)</li> <li>- 50% effective concentration (EC50)</li> <li>- minimum concentration that produces an observable effect (MCOE)</li> </ul> <p>4.4 Exact verification of the sample's ecotoxicity by:</p> <ul style="list-style-type: none"> <li>- evaluation of the biomass</li> <li>- lethality tests</li> <li>- growth inhibition tests</li> </ul> <p>4.5 Precise calculation of the toxic unit.</p> <p>4.6 Careful verification of the efficiency of a bioremediation procedure.</p>

CODE: 0IEF	
5. To analyze the results.	5.1 Precise reading of the results. 5.2 Correct analysis of the results. 5.3 Evidence of critical thinking in the final analysis.
6. To validate the results.	6.1 Proper validation of the results according to the standards. 6.2 Appropriate statistical treatment of data using software. 6.3 Periodic instrument calibration according to quality assurance standards.
7. To produce a report.	7.1 Correct entry of data into the computer. 7.2 Data presentation using tables and graphs. 7.3 Complete, clear and concise report. 7.4 Clarity of oral presentation.
8. To maintain the work environment.	8.1 Safe cleaning and decontamination of equipment and work environment. 8.2 Maintenance, calibration and minor repair of devices in accordance with manufacturer's standards. 8.3 Safe disposal of contaminated waste.





CODE: 01EG	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To perform applied biochemical analyses.</p> <p><b>Elements of the Competency</b> 1. To plan the work.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a research or quality control laboratory of a pharmaceutical or agro-food company, an environmental agency or a biotechnology company.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocols or standard methods</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>samples</li> <li>products required</li> <li>appropriate equipment: chromatographs, spectrometers, electrophoresis apparatus, centrifuge and ultracentrifuge, a cold room for chromatography and homogenizer</li> <li>computer, appropriate software and the Internet</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying attention to precision, minute details and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Proper interpretation of received instructions and protocol or standard operational methods.</p> <p>1.2 Search for pertinent information using appropriate tools.</p> <p>1.3 Realistic and efficient work planning taking into account requirements associated with manipulating biomolecules and living organisms.</p>

CODE: 01EG	
2. To prepare the material.	<p>2.1 Proper choice of:</p> <ul style="list-style-type: none"> <li>- materials</li> <li>- solutions and buffer solutions</li> <li>- reagents</li> <li>- enzymes</li> </ul> <p>2.2 Proper preparation of equipment and products.</p> <p>2.3 Proper preservation of products according to their stability.</p> <p>2.4 Proper preparation of organisms used:</p> <ul style="list-style-type: none"> <li>- laboratory animals</li> <li>- cell cultures</li> <li>- microorganisms</li> </ul> <p>2.5 Preparation and precise calibration of equipment.</p> <p>2.6 Entry of analysis parameters.</p>
3. To prepare the sample.	<p>3.1 Correct application of the method for extracting and separating biomolecules.</p> <p>3.2 Proper preservation of biomolecules while in solution.</p>

CODE: 01EG

4. To determine biomolecule activity.	<p>4.1 Proper choice of biomolecule purification method.</p> <p>4.2 Careful maintenance of the molecule's biological activity during purification.</p> <p>4.3 Correct application of assay method using:</p> <ul style="list-style-type: none"><li>- biosensors</li><li>- electrophoresis</li><li>- chromatography</li><li>- spectrometry</li></ul> <p>according to the specificity of each device and the characteristics of the biomolecules and other biological compounds.</p> <p>4.4 Precise array of:</p> <ul style="list-style-type: none"><li>- proteins, carbohydrates, lipids and nucleic acids</li><li>- hormones</li><li>- vitamins</li><li>- enzymes</li><li>- electrolytes</li><li>- metabolites</li><li>- chemical elements</li></ul> <p>4.5 Precise determination of the kinetics of enzymatic reactions.</p> <p>4.6 Correct determination of metabolic paths taking into account catabolism and intracellular anabolism.</p> <p>4.7 Proper determination of <i>in vivo</i> biological activities taking into account both animal and plant physiology.</p>
5. To analyze the results.	<p>5.1 Precise reading of the results.</p> <p>5.2 Proper validation of the results according to the standards.</p> <p>5.3 Exact mathematical and statistical analysis of the results using appropriate software.</p>
6. To produce a report.	<p>6.1 Correct entry of data into the computer.</p> <p>6.2 Data presentation using tables and graphs.</p> <p>6.3 Complete, clear and concise report.</p> <p>6.4 Clarity of oral presentation.</p>

CODE: 01EG	
7. To maintain the work environment.	<p>7.1 Proper cleaning of materials, equipment and work area.</p> <p>7.2 Maintenance, calibration and minor repair of devices in accordance with manufacturer's standards and quality assurance standards.</p> <p>7.3 Safe disposal of waste.</p>

CODE: 01EH	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To perform applied microbiological analyses.</p> <p><b>Elements of the Competency</b></p> <p>1. To plan the work.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a research or quality control laboratory of a pharmaceutical, agro-food or biotechnology company or environmental agency.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocols or standard methods</li> <li>clients' requests</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>samples</li> <li>products required</li> <li>appropriate equipment: sterilization equipment, incubators, bright-field microscope, phase-contrast or fluorescence microscope, automatic identification system and a laminar flow hood</li> <li>a computer, appropriate software and the Internet</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>sterile conditions</li> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying close attention to precision, minute details, efficiency and professional ethics.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Correct interpretation of the directions received, the protocol or standard operations.</p> <p>1.2 Search for pertinent information using appropriate tools.</p> <p>1.3 Realistic and efficient work planning taking into account requirements of growing prokaryotic et eukaryotic microorganisms.</p>

CODE: 01EH

2. To prepare the material.	2.1 Proper choice of: <ul style="list-style-type: none"><li>- glassware</li><li>- solutions</li><li>- reagents</li><li>- culture media</li></ul> 2.2 Proper preparation of equipment and the culture media.
3. To prepare the sample.	2.3 Proper choice of sterilization method.
	2.4 Proper preservation of culture media.
	2.5 Proper storage of equipment.
4. To determine the activities of prokaryotae and eukaryotae microorganisms.	3.1 Proper choice of: <ul style="list-style-type: none"><li>- method of extracting microorganisms</li><li>- enrichment media and reagents</li></ul> 3.2 Proper preparation of homogenate for analysis.
	3.3 Proper preservation of microorganisms.
	4.1 Proper evaluation of the risks associated with the presence of microorganisms.
	4.2 Proper choice of the method for counting the total number of microorganisms.
	4.3 Proper differentiation between normal and pathogenic flora and their effect on health.
	4.4 Precise identification of microorganism species and subspecies using different methods: <ul style="list-style-type: none"><li>- biochemical macrotests and microtests</li><li>- rapid screening tests</li><li>- bacteriophage typing</li><li>- automated systems</li><li>- chromatographic methods</li><li>- genomic maps</li></ul> 4.5 Determination of the presence of endotoxins, mycotoxins and other pyrogens.
	4.6 Exact determination of the concentration of antibiotics, vitamins and other products.
	4.7 Observance of the rules for working in a sterile room.
5. To analyze the results.	5.1 Proper reading of the results.
	5.2 Correct analysis of the data.
	5.3 Evidence of critical thought in the final analysis.

CODE: 01EH

6. To validate the results.	6.1 Proper validation of the results according to the standards. 6.2 Exact mathematical and statistical analysis of the data using appropriate software. 6.3 Periodic calibration of the instruments.
7 To produce a report.	7.1 Correct entry of data into the computer. 7.2 Data presentation using tables and graphs. 7.3 Complete, clear and concise report. 7.4 Clarity of oral presentation.
8. To maintain the work environment.	8.1 Safe cleaning and decontamination of the equipment and work area. 8.2 Safe disposal of contaminated and non-contaminated waste. 8.3 Maintenance and minor repair of equipment in accordance with manufacturer's and quality assurance standards. 8.4 Periodic verification, according to quality assurance standards, of the number of microorganisms in the ambient air. 8.5 Any necessary laboratory decontamination.





CODE: 01EJ	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To perform activities related to genetic engineering.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a research or quality control laboratory of a pharmaceutical, agro-food or biotechnology company or environmental agency.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>protocols or standard methods</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>microorganisms or cells</li> <li>products required</li> <li>appropriate equipment: microcentrifuges, ultracentrifuge, PCR (DNA amplification) device, nucleic acid transfer apparatus, electrophoresis devices, DNA sequencer, densitometer, digital DNA sequence analyzer and an electroporation apparatus</li> <li>a computer, appropriate software and the Internet</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>sterile conditions</li> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying attention to minute detail, demonstrating professional work ethics and showing respect for others.</li> </ul>
<p><b>Elements of the Competency</b></p> <p>1. To plan the work.</p>	<p><b>Performance Criteria</b></p> <p>1.1 Correct interpretation of the directions received, the protocol or standard operations.</p> <p>1.2 Search for pertinent information using appropriate tools.</p> <p>1.3 Realistic and efficient work planning taking into account requirements related to product stability and cell and microorganism culture growth.</p> <p>1.4 Proper evaluation of the risks associated with using radioactive and toxic products.</p>

CODE: 01EJ

2. To prepare the material.

2.1 Proper choice of:

- solutions and reagents
- enzymes
- culture media
- solid supports

2.2 Proper and safe preparation of materials and products.

2.3 Proper handling of radioactive products.

2.4 Proper choice of sterilization method.

2.5 Proper preservation and storage of products and culture media.

2.6 Appropriate equipment preparation and calibration.

3. To prepare the sample.

3.1 Proper seeding of prokaryotic and eukaryotic cells.

3.2 Appropriate cell immortalization and amplification.

3.3 Proper extraction and purification of nucleic acids.

3.4 Precise aliquoting of the samples.

3.5 Proper preservation of samples.

CODE: 01EJ

4. To perform genetic manipulations.	<p>4.1 Correct manipulation of nucleic acids by:</p> <ul style="list-style-type: none"><li>- nucleotide labelling</li><li>- using labeled probes</li><li>- electrophoresis in a gel</li><li>- gel and membrane nucleic acid transfer</li><li>- site-specific mutagenesis</li><li>- nucleic acids amplification</li><li>- nucleic acid sequencing</li><li>- preparation of complementary DNA</li><li>- nucleic acid hybridization as well as Northern and Southern blots</li></ul> <p>4.2 Appropriate use of cloning vectors or expression vectors in host cells.</p> <p>4.3 Correct performance of the cloning process.</p> <p>4.4 Precise identification of genes by screening the genomic and complementary DNA libraries using antibodies or nucleic acids as probes.</p> <p>4.5 Adequate production of recombinant cells and genetically-engineered organisms by:</p> <ul style="list-style-type: none"><li>- genetic recombination techniques for procaryotes</li><li>- eukaryotic, animal and plant cell transfection techniques</li></ul>
5. To analyze the results.	<p>5.1 Precise reading of the results.</p> <p>5.2 Proper validation of the data according to the standards.</p> <p>5.3 Exact mathematical and statistical analysis of the data using appropriate software.</p>
6. To produce a report.	<p>6.1 Correct entry of data into the computer.</p> <p>6.2 Data presentation using tables and graphs.</p> <p>6.3 Complete, clear and concise report.</p> <p>6.4 Clarity of oral presentation.</p>
7. To maintain the work environment.	<p>7.1 Safe cleaning and decontamination of materials, equipment and work area.</p> <p>7.2 Maintenance, calibration and minor repair of equipment according to manufacturer's and quality assurance standards.</p> <p>7.3 Safe disposal of chemical, biological and radioactive waste.</p> <p>7.4 Periodic verification of the presence of radioactivity in the laboratory.</p>



CODE: 01EK	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To use cells in bioprocesses.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in a laboratory of a pharmaceutical, agro-food or biotechnology company or environmental agency.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocols or standard methods</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– prokaryotic or eukaryotic cells</li> <li>– biomass residues</li> <li>– contaminated residues</li> <li>– products required</li> <li>– appropriate equipment: a bioreactor with parameter controls, large-volume centrifuge, anaerobic digester, biofilters, sterilization systems, laminar flow hood, incubator and instrumental analysis devices</li> <li>– computer, appropriate software and the Internet</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– sterile conditions</li> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> <li>– environmental standards</li> </ul> </li> <li>• Paying attention to precision, minute details and efficiency.</li> </ul>

CODE: 01EK

**Elements of the Competency**

1. To produce cells in bioreactors.

2. To synthesize metabolites.

**Performance Criteria**

- 1.1 Proper choice and preparation of culture media and materials according to constraints associated with industrial cell production.
- 1.2 Proper maintenance and sterilization of the bioreactor and its components.
- 1.3 Appropriate preparation and seeding of cell inoculum.
- 1.4 Precise control of:
  - culture purity
  - culture parameters
  - computer data
- 1.5 Precise evaluation of:
  - main parameters
  - oxygenation efficiency
  - number of cells
- 1.6 Proper collection of synthesized biomass.
- 1.7 Exact calculation of yield and productivity.
- 2.1 Proper choice of process:
  - discontinuous mode
  - continuous mode
  - anchorage-dependent or anchorage-independent culture
- 2.2 Proper choice of prokaryota and eukaryota cells for industrial use.
- 2.3 Precise determination of the conditions required for optimal metabolite production.
- 2.4 Proper control of growth and production kinetics.
- 2.5 Optimal metabolite retrieval without loss of activity.
- 2.6 Metabolite purification using the required separation techniques.
- 2.7 Exact metabolite assay.
- 2.8 Proper verification, using appropriate software, of bioprocess effectiveness.

CODE: 01EK

3. To lend economic value to the biomass.

- 3.1 Application of the optimal process to convert the biomass, according to its properties, for use as peat, or for use in the areas of forestry, aquatics, agriculture or urban development.
- 3.2 Proper control of living organisms involved in the biomass conversion process.
- 3.3 Proper control of recycling parameters.
- 3.4 Periodic and effective verification of the recycling process.
- 3.5 Proper collection of recycled products.
- 3.6 Careful evaluation of the state of recycled products.

4. To apply biodegradation procedures.

- 4.1 Proper choice of the bioremediation procedure for:
  - soils and sediments
  - water and liquid residues
- 4.2 Proper control of microorganisms used in biodegradation.
- 4.3 Proper control of biodegradation and bioremediation parameters:
  - aerobic process
  - anaerobic process
- 4.4 Proper application of biolixiviation processes.
- 4.5 Proper periodic checks on:
  - biodegradation
  - bioremediation
  - biolixiviation
- 4.6 Careful verification, according to environmental standards, of the effectiveness of the process.
- 4.7 Proper recycling of reusable products.





CODE: 01EL	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To characterize the chemical processes used in Québec's main industries.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To understand the basic concepts used in engineering processes.</li> <li>2. To interpret the schematics of processes.</li> <li>3. To describe the physical and chemical transformations that result from certain processes.</li> <li>4. To identify the principal pollutants.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Based on process designs: <ul style="list-style-type: none"> <li>– electrochemical</li> <li>– oil refining</li> <li>– polymer production</li> <li>– production of chemical products for industrial use</li> <li>– production of pulp and paper</li> <li>– production of pharmaceutical products</li> </ul> </li> <li>• Using documentation written in English or French.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Correct use of terminology used in engineering processes.</li> <li>1.2 Explanation of concepts such as: <ul style="list-style-type: none"> <li>– heat transfer</li> <li>– yield</li> <li>– material and energy balances</li> </ul> </li> <li>2.1 Clear distinction between continuous and discontinuous types of processes.</li> <li>2.2 Clear distinction between open and closed processes.</li> <li>2.3 Proper identification of unit operations.</li> <li>3.1 General description of physical and chemical phenomena.</li> <li>4.1 Correct identification of chemical pollutants resulting from the industrial processes.</li> </ol>



CODE: 01EM	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To use automated devices.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To interpret the operating instructions for an automated device.</li> <li>2. To prepare the reagents.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in a laboratory where routine analyses are performed, such as an environmental, pharmaceutical or agro-food laboratory. These methods are also used for the control of industrial processes.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– protocols or standard methods</li> <li>– instructions for using equipment</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– liquid, solid or gaseous samples</li> <li>– chemicals required</li> <li>– appropriate equipment: injection valves, peristaltic pumps and other sample treatment systems, spectrophotometric and photometric detectors</li> <li>– a computer, appropriate software and the Internet</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying close attention to quality and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Correct identification of a continuous or discontinuous automated analytical system.</li> <li>1.2 Correct outline of the analysis process in a continuous or sequential flux injection system as well as in a simple discontinuous system.</li> <li>1.3 Proper interpretation of the instructions.</li> <li>2.1 Proper choice of products: <ul style="list-style-type: none"> <li>– carrier liquid or mobile phase</li> <li>– reagents</li> </ul> </li> <li>2.2 Appropriate solution concentrations.</li> </ol>

CODE: 01EM	
3. To prepare the analysis system.	<p>3.1 Correct installation of accessories and modules of a continuous flux injection system:</p> <ul style="list-style-type: none"> <li>- injection system</li> <li>- detector</li> <li>- pumps</li> <li>- reactor(s)</li> </ul> <p>3.2 Proper adjustment of the sample volume, flux rate and other analysis parameters of a continuous flux injection system.</p> <p>3.3 Correct installation of accessories and modules of a discontinuous system:</p> <ul style="list-style-type: none"> <li>- automatic sampler</li> <li>- sampling tray</li> <li>- solutions</li> <li>- detector</li> </ul>
4. To apply the analysis protocol.	<p>4.1 Correct programming of the robot for discontinuous analysis.</p> <p>4.2 Proper optimization of the analysis parameters.</p> <p>4.3 Analyte amount.</p> <p>4.4 Rigorous quality control.</p> <p>4.5 Appropriate use of data processing capability.</p>
5. To maintain the equipment.	<p>5.1 Maintenance and minor repair of equipment.</p> <p>5.2 Proper validation of the equipment.</p> <p>5.3 Adherence to quality assurance standards.</p>

CODE: 01EN	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To prepare samples.</p> <p><b>Elements of the Competency</b> 1. To carry out treatment of raw samples.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• In all laboratories in any domain, sample preparation is a prerequisite for all analysis protocols.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– analysis protocols or standard methods</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– raw samples</li> <li>– required products and equipment</li> <li>– appropriate chemicals such as inorganic acids, flux, etc.</li> <li>– appropriate equipment such as a microwave oven, bomb calorimeter, automated extraction devices and a Soxhlet</li> <li>– safety accessories</li> <li>– a computer, appropriate software and the Internet</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Correct application of appropriate techniques for solid samples:</p> <ul style="list-style-type: none"> <li>– drying</li> <li>– grinding</li> <li>– pulverizing</li> <li>– sieving</li> <li>– division</li> </ul> <p>1.2 Correct application of appropriate techniques for liquid samples:</p> <ul style="list-style-type: none"> <li>– filtering</li> <li>– decanting</li> <li>– centrifuging</li> <li>– evaporating</li> </ul>

CODE: 01EN	
2. To dissolve solid samples.	2.1 Complete dissolution of samples using heat and strong acid aqueous solutions in an open container or by using organic solvents, depending on the appropriate technique.
3. To decompose the samples.	3.1 Complete decomposition of the samples by: <ul style="list-style-type: none"> <li>- placing them in a closed container of acid and heating it in a microwave oven</li> <li>- burning them in air or oxygen</li> <li>- fusion</li> </ul>
4. To eliminate interferences.	4.1 Use of an appropriate masking agent. 4.2 Use of an appropriate separation technique, such as: <ul style="list-style-type: none"> <li>- precipitation</li> <li>- extraction</li> <li>- distillation</li> </ul>
5. To concentrate the samples.	5.1 Use of appropriate enrichment techniques, such as: <ul style="list-style-type: none"> <li>- phase transition</li> <li>- liquid extraction</li> <li>- precipitation</li> <li>- ion exchange</li> <li>- electrolysis</li> <li>- cartridge</li> </ul>
6. To label the sample.	6.1 Labelling according to company standards.

CODE: 01EP	
OBJECTIVE	STANDARD
Statement of the Competency	Achievement Context
<p>To perform gravimetric analyses.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To interpret the instructions.</li> <li>2. To prepare the reagents.</li> <li>3. To prepare the sample.</li> </ol>	<ul style="list-style-type: none"> <li>• Working in a quality control or research and development laboratory of a company in the industrial chemistry, environmental, agro-food, pharmaceutical, metal transformation, mining or other sector.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– analysis protocols or standard methods</li> <li>– methods for using a balance</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– raw samples</li> <li>– products and equipment required</li> <li>– chemicals, such as precipitating reagents and strong acids</li> <li>– appropriate equipment: crucibles, device for measuring moisture, analytical balances, muffle furnace, drying agents, centrifuge</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Proper understanding of the documentation: <ul style="list-style-type: none"> <li>– analysis protocol or standard methods</li> <li>– operational modes of the balances</li> </ul> </li> <li>2.1 Proper choice of: <ul style="list-style-type: none"> <li>– dissolution agent</li> <li>– precipitating agent</li> <li>– cleaning solution</li> <li>– solid absorbent</li> </ul> </li> <li>2.2 Appropriate solution concentrations.</li> <li>3.1 Proper absorption.</li> <li>3.2 Proper drying.</li> <li>3.3 Complete dissolution.</li> </ol>

CODE: 01EP	
4. To apply the analysis protocol.	4.1 Proper preparation of the crucibles. 4.2 Verification of the precision of the analytic balance. 4.3 Correct adjustment of the precipitation conditions. 4.4 Correct digestion of the precipitate. 4.5 Precipitation of the analyte. 4.6 Any necessary decantation and filtration of the precipitate. 4.7 Proper heating and calcination of the precipitate or volatilization of the sample. 4.8 Proper drying of the precipitate. 4.9 Precise weighing of the precipitate.
5. To interpret the results.	5.1 Precise determination of the concentration. 5.2 Correct comparison of results against the established quality standards.
6. To submit the results.	6.1 Observance of rules for keeping a laboratory notebook. 6.2 Transmission according to company standards. 6.3 Proper evaluation of the reliability of the results.
7. To maintain the equipment.	7.1 Maintenance and minor repair according to manufacturer's standards. 7.2 Verification of analytical balances. 7.3 Adherence to quality assurance standards.



CODE: 01EQ	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To perform titrimetric analyses.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To interpret the instructions.</li> <li>2. To prepare the reagents.</li> <li>3. To prepare the sample.</li> <li>4. To apply the analysis protocol.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in a quality control or research and development laboratory of a company in the industrial chemistry, environmental, agro-food, pharmaceutical, metal transformation, mining or other sector.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– analysis protocols or standard methods</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– raw samples</li> <li>– products and equipment required</li> <li>– analytical balance</li> <li>– safety accessories</li> <li>– a computer and appropriate software</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Proper interpretation of the analysis protocol or the standard operations.</li> <li>2.1 Proper choice of the titrant.</li> <li>2.2 Appropriate solution concentrations.</li> <li>2.3 Standardization of the titrant.</li> <li>2.4 Proper choice of indicator.</li> <li>3.1 Proper digestion and dissolution of the sample.</li> <li>4.1 Proper choice of titration method: <ul style="list-style-type: none"> <li>– direct</li> <li>– back titration</li> <li>– displacement</li> </ul> </li> <li>4.2 Precise adjustment of the initial volume using a burette.</li> <li>4.3 Appropriate sample volume.</li> <li>4.4 Precise identification of the titration endpoint.</li> </ol>

CODE: 01EQ	
5. To interpret the results.	5.1 Proper interpretation of titration curves. 5.2 Precise determination of the concentration. 5.3 Correct comparison of results against the established quality. 5.4 Appropriate statistical treatment of results.
6. To submit the results.	6.1 Observance of rules for keeping a laboratory notebook. 6.2 Submission of results according to company standards. 6.3 Proper evaluation of the reliability of the results.
7. To maintain the equipment.	7.1 Maintenance according to the standards. 7.2 Calibration of measuring devices. 7.3 Adherence to quality assurance standards.

CODE: 01ER	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To perform electrochemical analyses.</p> <p><b>Elements of the Competency</b> 1. To interpret the instructions.  2. To prepare the reagents.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a trace analysis or quality control laboratory of a company in the environmental, agro-food, pharmaceutical, cosmetic, chemical, petrochemical or metallurgic sector.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>analysis protocols or standard methods</li> <li>operational modes of the equipment</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>raw samples</li> <li>products required</li> <li>appropriate equipment: various electrodes, electrolysis cells, DC current generator, galvanometer/potentiometer, automatic titration device, Karl Fischer titration device, trace voltage analyzer, conductance device, electrogravimetric measuring device, amperometric or coulometric titration cell, pH-meter and ion meter</li> <li>a computer, appropriate software and the Internet</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Proper understanding of the documentation:</p> <ul style="list-style-type: none"> <li>analysis protocol or standard methods</li> <li>operational mode of the equipment</li> </ul> <p>2.1 Proper choice of reagents for:</p> <ul style="list-style-type: none"> <li>coulometric, amperometric or conductometric titration</li> <li>trace analyses by voltammetry</li> <li>electrogravimetry</li> </ul> <p>2.2 Appropriate solution concentrations.</p>

CODE: 01ER

3. To prepare the sample.	3.1 Observance of proper techniques for preparing samples.
4. To prepare the device or setup.	4.1 Observance of the protocol for using the equipment. 4.2 Proper setup according to instructions.
5. To apply the analysis protocol.	5.1 Proper installation of: <ul style="list-style-type: none"><li>- working, reference and auxiliary electrodes</li><li>- conductivity cell</li><li>- electrolysis cell</li><li>- potentiostat/galvanostat</li><li>- multimeter</li></ul> 5.2 Precise adjustment of: <ul style="list-style-type: none"><li>- potential</li><li>- current intensity</li><li>- resistance</li></ul> 5.3 Choice of method for detecting the titration endpoint, if necessary. 5.4 Choice of voltammetry method, if necessary. 5.5 Appropriate use of any necessary parameter control software.
6. To interpret the results.	6.1 Proper interpretation of titration curves. 6.2 Concentration precision. 6.3 Proper comparison of the results to the proper quality standards. 6.4 Appropriate statistical treatment of results.
7. To submit the results.	7.1 Observance of rules for keeping a laboratory notebook. 7.2 Transmission according to company standards. 7.3 Evaluation of the reliability of the results.
8. To maintain the electrodes and equipment.	8.1 Maintenance and minor repair of electrodes and equipment according to the manufacturer's standards. 8.2 Adherence to quality assurance standards.

CODE: 01ES	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To perform atomic spectrometry analyses.</p> <p><b>Elements of the Competency</b> 1. To interpret the instructions.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a quality control or research and development laboratory of a company in the industrial chemicals, agro-food, mining or metallurgic sector, an environmental laboratory or any other laboratory that deals with metal identification or assay.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions</li> <li>analysis protocols or standard methods</li> <li>operational modes of the equipment</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>samples, having undergone an preliminary preparation</li> <li>chemicals required</li> <li>appropriate equipment: atomic absorption spectrometer with flame atomization, graphite oven, cold or hydride vapour generator, atomic emission spectrometer with flame atomization, inductively coupled plasma (ICP) or arc lamp</li> <li>a computer, appropriate software and the Internet</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b> 1.1 Proper understanding of the documentation: <ul style="list-style-type: none"> <li>analysis protocol or standard methods</li> <li>operating instructions for equipment</li> </ul> </p>

CODE: 01ES

2. To prepare the reagents.	2.1 Proper choice of products. 2.2 Appropriate concentration of: <ul style="list-style-type: none"><li>- blanks</li><li>- calibration standards</li><li>- samples in solution</li><li>- matrix modifiers</li></ul>
3. To prepare the sample immediately.	3.1 Proper correction of any final matrix interferences. 3.2 Final preparation of the sample.
4. To prepare the equipment.	4.1 Proper choice of technique. 4.2 Correct installation of: <ul style="list-style-type: none"><li>- the lamp according to the metal to be analyzed</li><li>- the burner, graphite oven, inductive plasma torch or accessories necessary for cold vapour or a hydride generator</li></ul> 4.3 Correct setting and adjustment for flame atomization, a graphite oven and other parameters: <ul style="list-style-type: none"><li>- wavelength</li><li>- any necessary temperature sequences</li><li>- width of spectrometer slit</li><li>- current lamp</li><li>- lamp alignment</li><li>- air and acetylene flow rate</li><li>- instrument calibration using a blank</li><li>- vertical and horizontal burner position</li><li>- graphite furnace position</li></ul> 4.4 Determination of the detection limit as well as positions to correct for parasitic effects, linearity zone and interferences for each analytical line of the plasma or electric arc emission spectrometry. 4.5 Appropriate use of parameter control software.
5. To apply the analysis protocol.	5.1 Proper optimization of analysis parameters. 5.2 Establish a calibration curve based on calibration standards. 5.3 Correct emission spectrum. 5.4 Proper performance of quality control operations. 5.5 Equipment shutdown according to proper protocols.

CODE: 01ES	
6. To interpret the results.	6.1 Exact identification of elements using reference spectra. 6.2 Precise determination of the concentration. 6.3 Correct comparison of results against the appropriate quality standards. 6.4 Appropriate statistical treatment of results.
7. To submit the results.	7.1 Observance of rules for keeping a laboratory notebook. 7.2 Submission according to company standards. 7.3 Evaluation of the reliability of the results.
8. To maintain the atomic spectrometer.	8.1 Maintenance and minor repair of the equipment according to the manufacturer's standards. 8.2 Cleaning of the burner head, if necessary. 8.3 Correct validation of the equipment. 8.4 Adherence to quality assurance standards.





CODE: 01ET	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b> To perform thermal analyses.</p> <p><b>Elements of the Competency</b></p> <ol style="list-style-type: none"> <li>1. To understand the instructions.</li> <li>2. To choose the reference material.</li> <li>3. To prepare the sample and standards.</li> </ol>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>• Working in a quality control or research and development laboratory of a company working in a field such as industrial chemicals (polymers, for example), pharmaceuticals, food, oils and lubricants, ceramics, ores, metals and alloys.</li> <li>• Based on: <ul style="list-style-type: none"> <li>– instructions</li> <li>– analysis protocols or standard methods</li> <li>– operating instructions for the equipment</li> </ul> </li> <li>• Using: <ul style="list-style-type: none"> <li>– a solid substance or a mixture of solid substances</li> <li>– chemicals required</li> <li>– appropriate equipment: devices to perform thermogalvanometry, differential scanning thermoanalysis or differential scanning calorimetry</li> <li>– a computer, appropriate software and the Internet</li> <li>– documentation written in English or French</li> </ul> </li> <li>• Respecting: <ul style="list-style-type: none"> <li>– health and safety regulations</li> <li>– Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>• Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <ol style="list-style-type: none"> <li>1.1 Proper understanding of the documentation: <ul style="list-style-type: none"> <li>– analysis protocol or standard method</li> <li>– operating instructions for equipment</li> </ul> </li> <li>2.1 Proper choice of the reference material, if necessary.</li> <li>3.1 Proper preparation of the sample and standards.</li> </ol>

CODE: 01ET

4. To prepare the equipment for thermal measurement.	<p>4.1 Proper choice of:</p> <ul style="list-style-type: none"><li>- crucibles</li><li>- gases</li></ul> <p>4.2 Correct installation of:</p> <ul style="list-style-type: none"><li>- crucibles</li><li>- sample tray</li><li>- thermocouples</li><li>- heads</li><li>- calorimeters</li></ul> <p>4.3 Correct and safe operational testing of the accessories.</p> <p>4.4 Precise setting or adjustment of:</p> <ul style="list-style-type: none"><li>- temperature</li><li>- gas pressure</li><li>- coolant quantity</li></ul> <p>4.5 Proper colorimeter calibration.</p> <p>4.6 Correct zeroing of the thermobalance.</p> <p>4.7 Appropriate use of parameter control software.</p>
5. To apply the analysis protocol.	<p>5.1 Proper optimization of analysis parameters.</p> <p>5.2 Thermal analysis graph.</p> <p>5.3 Correct performance of quality control operations.</p> <p>5.4 Equipment shutdown according to proper protocols.</p>
6. To interpret the results.	<p>6.1 Careful study of a substance's thermal behaviour.</p> <p>6.2 Precise determination of:</p> <ul style="list-style-type: none"><li>- a substance's enthalpy</li><li>- percentage of crystallinity of a polymer</li><li>- percentage of hydration of a substance, its molecular formula and concentration</li></ul> <p>6.3 Precise phase diagram for the substance.</p> <p>6.4 Correct comparison of results against the appropriate standards.</p> <p>6.5 Appropriate statistical treatment of results.</p>
7. To submit the results.	<p>7.1 Observance of rules for keeping a laboratory notebook.</p> <p>7.2 Submit results according to company standards.</p> <p>7.3 Evaluation of the reliability of the results.</p>

CODE: 01ET	
8. To maintain the equipment.	8.1 Maintenance and minor repair of the equipment according to the manufacturer's standards. 8.2 Adherence to quality assurance standards.



CODE: 01EU	
OBJECTIVE	STANDARD
<p><b>Statement of the Competency</b></p> <p>To perform organic and inorganic chemical analyses using instrumental and manual methods.</p> <p><b>Elements of the Competency</b></p> <p>1. To plan the work.</p> <p>2. To collect a sample.</p>	<p><b>Achievement Context</b></p> <ul style="list-style-type: none"> <li>Working in a quality control or research and development laboratory of a company in any one of the various sectors. The work involves participating in the development of methods of analysis.</li> <li>Based on: <ul style="list-style-type: none"> <li>instructions or clients' requests, analysis protocols or standard methods</li> <li>operating instructions for equipment</li> </ul> </li> <li>Using: <ul style="list-style-type: none"> <li>solid, liquid or gaseous samples of diverse origin</li> <li>chemicals required</li> <li>appropriate equipment</li> <li>computers, appropriate software and the Internet</li> <li>documentation written in English or French</li> </ul> </li> <li>Respecting: <ul style="list-style-type: none"> <li>health and safety regulations</li> <li>Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP) or the standards of the International Organization for Standardization (ISO)</li> </ul> </li> <li>Paying close attention to precision, minute detail and efficiency.</li> </ul> <p><b>Performance Criteria</b></p> <p>1.1 Proper understanding of the documentation: <ul style="list-style-type: none"> <li>analysis protocol or standard method</li> <li>operating instructions for equipment</li> </ul> </p> <p>1.2 Research of pertinent information with the aid of appropriate tools.</p> <p>1.3 Realistic and efficient work planning taking into account: <ul style="list-style-type: none"> <li>deadlines</li> <li>time required to prepare the sample and the equipment as well as the time required to perform the analysis</li> <li>the requirements of the clientele</li> </ul> </p> <p>2.1 Proper application of the sampling protocol.</p> <p>2.2 Sample representativeness.</p>

CODE: 01EU	
3. To prepare a laboratory sample.	3.1 Appropriate treatment of the raw sample. 3.2 Complete decomposition and dissolution of the sample. 3.3 Complete elimination of interferences. 3.4 Appropriate concentration.
4. To prepare the material.	4.1 Appropriate preparation of reagents. 4.2 Appropriate preparation of the equipment. 4.3 Appropriate preparation of the instruments.
5. To identify the sample components.	5.1 Proper application of qualitative analysis techniques. 5.2 Proper application of analysis techniques using instruments.
6. To quantitate the analyte.	6.1 Exact observance of the analysis protocol. 6.2 Exact account of the analysis protocol entered in the laboratory notebook. 6.3 Precise reading of the measurements. 6.4 Appropriate comparison of the results with the accepted standards. 6.5 Required repetition of all analyses producing divergent results within a single group of samples. 6.6 Appropriate processing of the data.
7. To estimate the reliability of the results.	7.1 Proper evaluation of the reliability of the results. 7.2 Appropriate statistical treatment of results. 7.3 Proper interpretation of results. 7.4 Proper determination of the cause of any errors.
8. To produce a report.	8.1 Observance of laboratory report presentation rules. 8.2 Complete, clear and precise report. 8.3 Proper communication of the results in English or French. 8.4 Proper archiving of the results.

CODE: 01EU	
9. To maintain the work area.	9.1 Proper storage of materials and solutions. 9.2 Proper cleaning of the work area. 9.3 Safe disposal of waste. 9.4 Proper preventive maintenance of equipment. 9.5 Minor repair of the equipment.





## **EDUCATIONAL INTENTIONS OF GENERAL EDUCATION**

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### **GENERAL EDUCATION COMMON TO ALL PROGRAMS AND GENERAL EDUCATION ADAPTED TO PROGRAMS**

#### **English, Language of Instruction and Literature**

##### **General Education Common to All Programs**

The three sets of objectives and standards in English, Language of Instruction and Literature, pursue two general goals: mastery of the language of instruction and exploration of the riches of the literary heritage. Achievement of these goals is intended to bring the students to a college level of proficiency in the areas of reading, writing, listening and speaking. Building on the skills developed by students on completion of secondary school, the English program places a marked emphasis on written production and reading comprehension while at the same time consolidating listening and speaking skills.

The mastery of language skills will be achieved through regular and ongoing observance of the rules of correct writing and speaking and the production of texts supported by reading and the study of literature. Students will also be encouraged to develop an appreciation of literature by becoming acquainted with a number of significant literary works representative of various genres and periods and expressing a variety of literary themes. Both the aesthetic and cultural value of these texts and their formal aspects will be the objects of study.

All students entering college will begin their English studies with an introductory set of objectives and standards. This set has two possible formats. While both provide a range of reading, writing and literary activities, one includes additional reinforcement of reading and writing skills.

##### **General Education Adapted to Programs**

The set of objectives and standards for English, Language of Instruction and Literature, is placed in the context of general education and is a complement to the general education common to all programs. Students will develop the skills required in order to communicate in the forms of discourse appropriate to their field of study.

##### **Outcome Objectives**

Students who have achieved the general education objectives in English, Language of Instruction and Literature, will be able to:

- Demonstrate a college level of proficiency in the areas of reading, writing, listening and speaking.
- Develop their own ideas into arguments and theses, organize them and edit their work.
- Understand basic vocabulary and terminology used when discussing literature.
- Analyze literary works.

## **Humanities**

Humanities, as part of the core curriculum, is intended to promote personal and social development and to give students a foundation that will help them understand their roles in contemporary society as members of the labour force, citizens, and individuals. The three sets of objectives and standards in Humanities propose common frameworks for understanding the experiences, ideas and values of humankind and their diversity. They are aimed at developing critical thinking, reinforcing the ancillary skills involved in careful reading, organized writing, and well-developed oral presentations, and, where appropriate, improving media and computer literacy. Once students have mastered the three-stage process of analysis, synthesis and evaluation, they will be able to reflect in an informed manner and to communicate what they have learned in an organized and coherent fashion.

## **Principles**

- 1) Humanities constitutes a thematic, multidisciplinary, at times transdisciplinary, exploration of humankind, including its accomplishments, failures, abilities, creations, ideas, and values.
- 2) Humanities helps students to recognize, define and classify information and provides them with common frameworks for diverse methods of analyzing, synthesizing and evaluating conceptions of society, knowledge and values.
- 3) Humanities aims to prepare students for common civic responsibilities and the exercise of rights.
- 4) Humanities pursues the general goal of developing critical thought, valuing it, and recognizing its limitations.

## **Outcome Objectives**

Students who have achieved the general education objectives in Humanities will be able to:

- Describe, explain and organize main elements, ideas, values and implications of a world-view in a coherent fashion.
- Compare world-views.
- Recognize the basic elements in a specific example of the organization, transmission, and use of knowledge.
- Define the dimensions, limits, and uses of knowledge in appropriate historical contexts.
- Identify, organize and synthesize the salient elements of a particular example of knowledge.
- Situate important ethical and social issues in their appropriate historical and intellectual contexts.
- Explain, analyze and debate ethical issues in a personal and professional context.

## **Sequence of Objectives and Standards**

The first two sets of objectives and standards in Humanities, which are part of the general education component common to all programs, develop similar skills in a recursive fashion.

In the first set the emphasis is on how knowledge is defined, acquired, classified, transmitted, and applied. Students examine both messages and media to identify the strengths and limitations of each. Students learn to situate knowledge in a social, historical and personal context, a skill they will need in order to become lifelong learners.

The second set focuses on how individuals, groups, societies or nations organize ideas, perceptions and values into explanatory patterns. Students explore major ideas and value systems by which diverse individuals, groups, societies or nations seek to explain the world and their place in it.

The third set, which is part of the general education component adapted to programs, is aimed at deepening and reinforcing the critical thinking skills developed in the first two sets. It is, therefore, sequenced so that students can build on the critical skills, knowledge and insights developed in the first two sets. By situating these issues in their appropriate world-view and knowledge contexts, students develop a critical and autonomous approach to ethical values in general and to the values involved in their own fields of interest in particular. This final set also provides students with an opportunity to consolidate personal and social values.

## **Français, langue seconde**

L'enseignement du français, langue seconde, contribue à la formation fondamentale de la personne, en même temps qu'il a pour objet de lui permettre de communiquer efficacement avec ses concitoyens et concitoyennes.

## **Principes**

- 1) La maîtrise du français, langue seconde, est essentielle pour quiconque veut participer pleinement à la vie de la société québécoise, dont le français est la langue officielle. En conséquence, la formation générale en français, langue seconde, a pour finalité de rendre les étudiants et les étudiantes aptes à utiliser de façon efficace les moyens dont dispose la langue pour communiquer en société. À cette fin, ils devront acquérir des connaissances en vue de les déployer dans les formes de discours qu'il leur faudra pratiquer.
- 1) À leur arrivée au collégial, les étudiants et les étudiantes ont déjà acquis des compétences dans les quatre habiletés langagières, à savoir : parler, lire, écouter et écrire, mais sont, de façon générale, plus compétents en matière d'expression orale. En conséquence, la formation porte sur le développement des quatre habiletés langagières tout en mettant l'accent sur la lecture et l'écriture.
- 2) En tant que partie intégrante de la formation générale, le français, langue seconde, contribue au développement de la pensée critique et de l'expression structurée.

## Résultats attendus

Tout étudiant ou toute étudiante qui a atteint les objectifs de formation générale en français, langue seconde, pourra, selon son niveau de compétence, montrer :

- sur le plan des connaissances, qu'il ou elle :
  - sait faire une présentation orale structurée;
  - connaît les différentes formes du discours;
  - connaît les différentes techniques de lecture et d'écriture;
- sur le plan des habiletés, qu'il ou elle :
  - est capable de questionner, d'analyser, de juger, et d'argumenter en français;
  - est apte à entretenir des rapports sociaux et à partager la vie culturelle du Québec;
  - est apte à établir, à poursuivre et à pratiquer des rapports professionnels en français;
- sur le plan des attitudes, qu'il ou elle :
  - fait preuve d'ouverture par rapport aux différents aspects de la culture québécoise;
  - a conscience des différences et des similitudes entre sa culture d'origine et la culture québécoise francophone;
  - a la préparation voulue pour s'insérer dans la vie sociale et économique.

## Séquence des objectifs et des standards

Pour répondre aux divers besoins d'apprentissage des étudiants et des étudiantes du collégial, les ensembles en français, langue seconde, sont répartis selon quatre niveaux. Chacun de ces niveaux permet d'amener les étudiants et les étudiantes à interpréter et à produire des textes de plus ou moins grande complexité.

La formation générale en français, langue seconde, comporte deux ensembles prévus en séquence. Le premier, qui fait partie de la formation générale commune à tous les programmes, a pour objet de consolider les connaissances linguistiques déjà acquises et de les développer pour amener les étudiants et les étudiantes à communiquer de façon plus précise sur le plan tant du vocabulaire et de la syntaxe que de l'organisation textuelle.

Le second ensemble, qui fait partie de la formation générale propre aux programmes, s'appuie sur les acquis développés dans le premier ensemble en les enrichissant d'éléments de compétence liés aux champs d'études de l'étudiant ou de l'étudiante. On cherche à développer la précision de l'expression dans des situations de communication particulières qui relèvent du champ d'études de l'étudiant ou de l'étudiante.

## **Physical Education**

Physical Education, as part of the core curriculum, is aimed at promoting the development of the whole person and at encouraging students to acquire responsible behaviours with respect to their health and quality of life.

### **Principles**

- 1) Physical Education introduces students to different ways of being physically active with a view to making them aware that they are responsible for their health. Students learn concepts and acquire knowledge drawn from the literature and methodically apply them to physical activities apt to lead them to adopt behaviours characteristic of a healthy lifestyle.
- 2) Physical Education enables students to improve their proficiency in an activity and, in doing so, serves to increase their motivation and perseverance to remain physically active, and makes them aware of the contributing factors. To this end, students use a learning process designed to enhance their aptitudes for a given physical activity (i.e. their skills and attitudes).
- 3) Physical Education contributes to making students responsible for assuming responsibility for their health through the maintenance and improvement of their physical fitness and through the sensible practice of physical activity. Students learn to combine being physically active in an effective manner with factors which promote health.
- 4) Physical Education makes students aware of the importance of sharing the knowledge they have acquired. The pleasure and sense of well-being students get out of Physical Education classes motivate them to encourage others to be physically active and to adopt healthy behaviours.

### **Outcome Objectives**

Students who have achieved the general education objectives in Physical Education will be able to demonstrate:

- their knowledge of:
  - The relationship between physical activity, lifestyle and health based on the findings of scientific research.
  - The scientific principles for improving or maintaining one's fitness.
  - Ways to assess their abilities and needs with respect to activities which can enhance their health.
  - The rules, techniques and conditions involved in different types of physical activity.
  - A method for setting goals.
  - The factors which facilitate making physical activity part of one's lifestyle.
- their ability to:
  - Choose physical activities on the basis of their motivation, abilities and needs.
  - Establish relationships between lifestyle and health.

- Apply the rules, techniques and conditions involved in different types of physical activity.
  - Set goals that are realistic, measurable, challenging, and situated within a specific time frame.
  - Improve their mastery of the basic techniques, tactics and strategies associated with sports, outdoor and expression-oriented activities.
  - Use their creative and communication skills, particularly in group activities.
  - Evaluate their skills, their attitudes and their progress with respect to different forms of physical activity.
  - Maintain or increase their physical activity level and fitness level on their own.
  - Manage a personal physical activity program and assume responsibility in the organization of physical activities.
- their capacity to (i.e. their attitudes):
- Recognize the importance of taking charge of their health.
  - Be aware of the need to evaluate and respect their abilities and how the activity is to be carried out, before initiating the activity.
  - Foster self-confidence, self-control, respect for others and cooperation, through the knowledge they have acquired and through participation in physical activity.
  - Respect the environment in which the activities are held.
  - Appreciate the aesthetic and play value of physical activity.
  - Promote a balanced and active lifestyle as a social value.

### **Sequence of Objectives and Standards**

The three sets of objectives and standards in Physical Education are designed in a learning sequence. The first two are prerequisites for the third.

The first set focuses on the relationship between good health and physical activity as related to a healthy lifestyle. Students are required to try one or more activities and to relate them to their abilities, needs, motivation, lifestyle and knowledge of health promotion. This enables them to make an appropriate and justified choice of physical activities.

The second set looks at the improvement of effectiveness through the use of a goal-oriented approach in a sport, outdoor or expression-oriented activity. After an initial assessment, students are called upon to evaluate their abilities and attitudes with respect to a physical activity, to set goals, and to interpret their progress.

The third set is aimed at bringing students to integrate physical activity into their lifestyle, more particularly through more effective management of factors which facilitate such an integration. During contact-hours with the teacher, students apply the knowledge they have acquired in the first two sets. This is done through the safe and effective practice of physical activity and through the development, realization and evaluation of a personal physical activity program, which students follow and validate under their teacher's supervision. The hours allotted for personal work enable students to complete their personal program.

## **COMPLEMENTARY GENERAL EDUCATION**

### **Social Sciences**

The two sets of objectives and standards aim to familiarize students with the social sciences and their particular approach to the human condition.

The first set supports learning activities that allow students to look at one or more of the social sciences in relation to major contemporary issues: subjects studied in the social sciences; contribution of the social sciences to an understanding of contemporary issues; issues facing the social sciences in the future.

The second set supports learning activities in the social sciences that allow students to rigorously analyze one of the major problems of our time, using one or more social scientific approaches.

### **Science and Technology**

In science and technology, the educational intention is to present science and technology as a specific approach to reality, in order to familiarize students with this field of knowledge. This general intention can take several forms, such as helping students gain experience with the scientific method or study the evolution, challenges and consequences of scientific and technological discoveries.

The first set of objectives and standards emphasizes the general nature and scope of science and technology.

The second set emphasizes using the scientific method.

### **Modern Languages**

The three sets of objectives and standards in modern languages introduce students to the basic language structures and vocabulary of a third language while making them aware of the culture of the people who speak the language.

Some modern languages use different structures and writing systems. The three sets have been developed in accordance with this fact. The degree of competency acquisition will therefore vary according to how distant the language is from the structure of our own language or system of thought. Furthermore, awareness of the culture of the people using a modern language does not figure as an element of competency, since learning a modern language implies acquiring an awareness of its culture.

## **Mathematics Literacy and Computer Science**

In mathematics literacy and computer science, the two sets of objectives and standards are based on the educational intention of developing mathematical and computer culture.

The educational intention of the first set is to lead students to consider the place, role and evolution of these knowledges and tools in our society and to describe their different uses. It consists of general education about the language of mathematics or computers, and does not include specialized training.

The second set targets the understanding and use of the language of mathematics or computers for everyday purposes. This intention refers mainly to the concepts, tools and general uses of mathematical or computer language in daily life.

Since the objectives and standards for the field of mathematics literacy and computer science are of a general nature, they can be used to define various learning activities that foster development of competencies in mathematics or computer science, or in a combination of these two areas.

## **Art and Aesthetics**

In art and aesthetics, the educational intention is to allow students to acquire general cultural knowledge by exploring various forms of art in one or more artistic fields. This basic education is intended to develop an artistic sensibility through exposure to works of art or experimentation in an artistic medium. Furthermore, it aims to teach the fundamental elements of the language of art and to enable students to make connections between those elements.

In the context of the first set of objectives and standards, students are introduced to works of art from contemporary culture and from other periods. This allows them to develop an appreciation for the dynamics of the imagination in art and to learn methods of analyzing artistic production.

In the context of the second set, students engage in creative or interpretive activities in a given artistic medium. As well, students are introduced to artistic works in that medium so that they may learn to recognize its primary forms of expression.





