



Science – International Baccalaureate (200.Z1)

Pre-University Program

College Education

2022 Version

This document was produced by the
Ministère de l'Enseignement supérieur.

Coordination and content

Service de la formation préuniversitaire et de la recherche
Direction des programmes de formation collégiale
Direction générale des affaires collégiales
Sous-ministériat du développement et du soutien des réseaux

Title of original document: *Sciences de la nature – Cheminement du Baccalauréat International*
(200.Z1) – Programme d'études préuniversitaires

English translation

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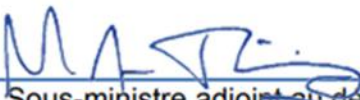
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ISBN 978-2-550-92268-1 (PDF)
ISBN 978-2-550-91616-1 (French, PDF)

DÉFINITION DU PROGRAMME D'ÉTUDES

Titre du programme	Sciences de la nature – Cheminement du Baccalauréat International
Type de programme	Programme d'études préuniversitaires
Code et version du programme	200.Z1 (2022)
Type de sanction	Diplôme d'études collégiales
Conditions particulières d'admission	Chimie de la 5 ^e secondaire Mathématique, séquence <i>Technico-sciences</i> ou <i>Sciences naturelles</i> , de la 5 ^e secondaire Physique de la 5 ^e secondaire
Nombre d'unités	58 $\frac{2}{3}$
Formation générale	26 $\frac{2}{3}$
Formation spécifique	32
Nombre de périodes d'enseignement	1560
Formation générale	660
Formation spécifique	900
Options	Sciences pures et appliquées Sciences de la santé
Session et année d'entrée en vigueur	Implantation facultative : Automne 2022 Implantation obligatoire : Automne 2024

APPROBATION

Recommandations :	 Sous-ministre adjoint au développement et au soutien des réseaux	<u>2022-05-17</u> Date
	 Sous-ministre	<u>2022-05-18</u> Date
Approbation de la ministre :	 	<u>2022-05-30</u> Date

DEFINITION OF THE PROGRAM

Program title	Science – International Baccalaureate
Type of program	Pre-university program
Program code and version	200.Z1 (2022)
Type of certification	Diploma of College Studies
Special conditions for admission	Secondary V Chemistry Secondary V Mathematics: Technical and Scientific option or Science option Secondary V Physics
Number of credits	58 $\frac{2}{3}$
General education component	26 $\frac{2}{3}$
Program-specific component	32
Number of periods of instruction	1560
General education component	660
Program-specific component	900
Options	Pure and Applied Science Health Science
Term and year entering into effect	Optional implementation: Fall 2022 Compulsory implementation: Fall 2024

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The Program

The Minister recognizes the *Science – International Baccalaureate* program leading to a Diploma of College Studies, though not established by him, as being equivalent to the *Science 200.B1* program.

Detailed information about the program can be obtained from the institutions authorized to offer the program.

The program is made up of a general education component and a program-specific component.

Program Objectives and Standards

List of objectives

Program-Specific Component

32 credits, 900 periods of instruction

Common Objectives for the *Pure and Applied Science Option*

- Biology (101)

0ZB1 Apply concepts and principles of biology in the context of the group 4 biology standard-level requirements of the International Baccalaureate program, a minimum of 2 credits

Or (objective taken from the *Science – 200.B1* program)

0B01 Explain the structures and functions of cells as the basic units of life, 2 credits

- Mathematics (201)

02A2 Apply concepts and principles of differential and integral calculus in the context of the group 5 Mathematics: analysis and approaches higher-level requirements of the International Baccalaureate program, a minimum of $4\frac{1}{3}$ credits

02A3 Apply concepts and principles of mathematics other than differential and integral calculus in the context of the group 5 Mathematics: analysis and approaches higher-level requirements of the International Baccalaureate program, a minimum of 5 credits

02A4 Apply concepts and principles of matrix algebra

- Chemistry (202)

0ZC1 Apply concepts and principles of chemistry in the context of the group 4 chemistry standard-level requirements of the International Baccalaureate program, a minimum of $4\frac{2}{3}$ credits

Or (objectives taken from the *Science – 200.B1* program)

0C01 Analyze properties of matter and chemical changes, $2\frac{2}{3}$ credits

0C02 Analyze chemical systems in solutions, 2 credits

- Physics (203)

0ZP1 Apply concepts and principles of physics in the context of the group 4 physics higher-level requirements of the International Baccalaureate program, a minimum of $7\frac{1}{3}$ credits

Or

0ZP2 Apply concepts and principles of physics in the context of the group 4 physics standard-level requirements of the International Baccalaureate program, a minimum of $7\frac{1}{3}$ credits

Common Objectives for the *Health Science Option*

- Biology (101)

0ZB2 Apply concepts and principles of biology in the context of the group 4 biology higher-level requirements of the International Baccalaureate program, a minimum of 5½ credits

Or

0ZB3 Apply concepts and principles of biology in the context of the group 4 biology standard-level requirements of the International Baccalaureate program, a minimum of 3½ credits

- Mathematics (201)

02A2 Apply concepts and principles of differential and integral calculus in the context of the group 5 Mathematics: analysis and approaches higher-level requirements of the International Baccalaureate program, a minimum of 4½ credits

02A3 Apply concepts and principles of mathematics other than differential and integral calculus in the context of the group 5 Mathematics: analysis and approaches higher-level requirements of the International Baccalaureate program, a minimum of 5 credits

02A4 Apply concepts and principles of matrix algebra

Or

02AA Apply concepts and principles of differential and integral calculus in the context of the group 5 Mathematics: applications and interpretation higher-level requirements of the International Baccalaureate program, a minimum of 3½ credits

02AB Apply concepts and principles of statistics and probability in the context of the group 5 Mathematics: applications and interpretation higher-level requirements of the International Baccalaureate program, a minimum of 2½ credits

02AC Apply concepts and principles of mathematics other than differential and integral calculus and statistics and probability in the context of the group 5 Mathematics: applications and interpretation higher-level requirements of the International Baccalaureate program, a minimum of 3 credits

- Chemistry (202)

0ZC2 Apply concepts and principles of chemistry in the context of the group 4 chemistry higher-level requirements of the International Baccalaureate program, a minimum of 6 $\frac{2}{3}$ credits

Or (objectives taken from the *Science – 200.B1* program)

0C01 Analyze properties of matter and chemical changes, 2 $\frac{2}{3}$ credits

0C02 Analyze chemical systems in solutions, 2 credits

0C0F Analyze the structure and reactivity of organic molecules, 2 credits

- Physics (203)

Objectives taken from the *Science – 200.B1* program

0P01 Analyze physical situations and phenomena using the fundamental laws and principles of classical mechanics, 2 $\frac{2}{3}$ credits

0P02 Analyze physical situations and phenomena using the fundamental laws and principles of electricity and magnetism, 2 credits

Or

0P01 Analyze physical situations and phenomena using the fundamental laws and principles of classical mechanics, 2 $\frac{2}{3}$ credits

0P03 Analyze physical situations and phenomena using the fundamental laws and principles of waves and modern physics, 2 $\frac{2}{3}$ credits

Optional Objectives for the *Pure and Applied Science* and the *Health Science* Options

- 0035¹ Communicate in a living language in the context of natural sciences according to the group 1 or group 2 language subject area of the International Baccalaureate program, Modern Languages (618)
- 0036 Discuss critically an issue related to natural sciences, according to the group 3 individuals and societies subject area of the International Baccalaureate program
- 0038² Apply concepts and principles specific to global issues, according to the profile of a student in the International Baccalaureate program
- 0039³ Apply methods specific to carrying out a research project in the context of the core requirements of the International Baccalaureate program
- 069N Apply concepts, theories, models and techniques associated with the experimental sciences in one or more of the group 4 subjects of the International Baccalaureate program
- 0ZF1 Explore concepts, theories, models and computer applications applied in one or more of the group 4 or 5 subjects of the International Baccalaureate program

Objective taken from the *Science* (200.B1) program

- 0F01 Develop software programs to automate problem solving in a scientific context, 2 credits

1. The modern languages in the 600 group are the following: 602 French as a second language, 604 English as a second language, 607 Spanish, 608 Italian, 609 German, 610 Russian, 611 Hebrew, 612 Yiddish, 613 Chinese, 616 Arabic.

2. Objective that can be achieved with courses comprising less than 45 periods of instruction.

3. Objective that can be achieved with courses comprising less than 45 periods of instruction.

General Education Component

26 $\frac{2}{3}$ credits, 660 periods of instruction

Commons Objectives

- 002U⁴ Discuss critically the role and nature of knowledge in the context of the core requirements of the International Baccalaureate program
- 002V Develop an appreciation of literary texts from different periods and of various genres in the language of instruction in the context of the group 1 requirements of the International Baccalaureate program

Optional Objectives

- 00H8 Discuss critically an issue related to the nature of individuals and societies in one or more of the group 3 subjects of the International Baccalaureate program
- 00H9⁵ Communicate in a living language in a range of contexts and for different purposes in one of the group 1 or group 2 languages of the International Baccalaureate program, Modern Languages (618)
- 0H10 Discuss critically and scientifically the concepts and foundations of science in one or more of the group 4 subjects of the International Baccalaureate program
- 4EP0 Analyze physical activity from the standpoint of lifestyle behaviours that promote health
- 4EP1 Improve effectiveness when practising a physical activity
- 4EP2 Demonstrate the ability to manage health-enhancing physical activity

⁴. Objective that can be achieved with courses comprising less than 45 periods of instruction.

⁵. The modern languages in the 600 group are the following: 602 French as a second language, 604 English as a second language, 607 Spanish, 608 Italian, 609 German, 610 Russian, 611 Hebrew, 612 Yiddish, 613 Chinese, 616 Arabic.

Program-Specific Component

Common Objectives and Standards taken from the Science (200.B1) program

Code: 0B01

<i>Objective</i>	<i>Standard</i>
Statement of the Competency	Performance Criteria for the Competency as a Whole
Explain the structures and functions of cells as the basic units of life.	• Appropriate use of terminology • Appropriate contextualization of biotechnology applications [1]
Elements of the Competency	Performance Criteria
1. Characterize the structure and function of cells.	• Summary distinction of viruses, prokaryotic cells and eukaryotic cells • Appropriate description of properties of the cell and the main organelles • Accurate description of the structure and functions of macromolecules
2. Characterize the processes of the cell cycle.	• Accurate description of the stages of the cell cycle • Appropriate underscoring of the interrelationship between the stages of mitosis and meiosis • Summary description of cell death process • Accurate description of the stages and characteristics of DNA replication
3. Characterize the functions of the metabolism on cell activity.	• Accurate description of the role and functioning of biological catalysts • Accurate distinction of membrane transport mechanisms • Summary description of the cellular respiration process
4. Explain the mechanisms of functional protein synthesis.	• Accurate description of the steps for producing a transcript and differential gene expression • Accurate application of the genetic code • Accurate characterization of the steps for synthesis of a functional protein • Accurate distinction of genic and chromosomal mutation types
5. Explain the effects of the genetic variation of the living.	• Accurate application of the basic concepts of Mendelian genetics • Accurate representation of models of inheritance [2] • Appropriate characterization of genetic variation among individuals • Summary description of genetic and chromosomal anomalies
6. Verify biology concepts using an experimental method.	• Appropriate use of laboratory techniques, equipment and measurement apparatus • Appropriate data processing • Communication of results according to established requirements • Effective contribution to teamwork

Learning Activities

Discipline: Biology

Weighting: 2-2-2

Credits: 2

Periods of instruction: 60

Indications:

Examples of content:

[1] Biotechnology applications:

- plasmids and cloning
- restriction enzymes
- DNA amplification
- use of biological databases
- other current applications of biotechnology

Additional information on content:

[2] Models of inheritance: incomplete and complete dominance, codominance, pleiotropy, multiple alleles, epistasis and polygenic heredity

Code: 0C01

<i>Objective</i>	<i>Standard</i>
Statement of the Competency	Performance Criteria for the Competency as a Whole
Analyze properties of matter and chemical changes.	• Appropriate use of terminology • Observance of mathematical and chemical formalism • Use and conversion of appropriate units of measurement • Consideration of environmental issues • Demonstration of rigour in the problem-solving approach
Elements of the Competency	Performance Criteria
1. Use chemical language and symbols.	• Relevant use of basic concepts and chemical symbols [1] • Accurate application of nomenclature rules of inorganic compounds
2. Carry out the quantitative analysis of chemical systems.	• Accurate application of the appropriate concepts for calculating quantities used in chemistry [2] • Accurate application of the rules of stoichiometry to different types of reactions [3]
3. Explain the properties of the elements and how they relate to the periodic classification.	• Appropriate description of the main characteristics of the probabilistic model of the atom • Appropriate description of atomic orbitals and electron configurations using quantum numbers • Summary demonstration of the relationship between the electron configuration and chemical properties of elements [4] • Accurate explanation of the main periodic properties of elements [5]
4. Explain the structure of matter according to the types of chemical bonds.	• Accurate distinction of compound types based on the type of bonds involved [6] • Exact calculations involving covalent bond energies • Appropriate determination of structures for polyatomic ions and molecular compounds [7] • Accurate description of atomic orbital hybridization [8]
5. Explain the main macroscopic properties of matter.	• Accurate distinction of intermolecular forces • Accurate determination of the relative strength of intermolecular forces • Accurate demonstration of the relationship between the physical properties of matter and the forces involved [9]
6. Verify, using an experimental method, some chemical and physical properties of matter.	• Appropriate use of laboratory techniques, equipment and measurement apparatus • Compliance with laboratory rules for health, safety and environmental protection • Appropriate data processing [10] • Relevance of the analysis and accuracy of the results • Communication of results according to established requirements • Effective contribution to teamwork

Learning Activities

Discipline: Chemistry

Weighting: 3-2-3

Credits: 2 $\frac{2}{3}$

Periods of instruction: 75

Indications:

Additional information on content:

- | | |
|---|--|
| <p>[1] Chemical concepts and symbols:</p> <ul style="list-style-type: none"> • atoms, isotopes, ions and molecules • atomic number and mass number • charge and oxidation state • chemical formulas (empirical and molecular) • types of elements: metals, nonmetals, metalloids • physical states <p>[2] Concepts and quantities:</p> <ul style="list-style-type: none"> • atomic mass, molar mass, number of moles • volumetric mass density, concentrations and units of concentration <p>[3] Rules of stoichiometry:</p> <ul style="list-style-type: none"> • balancing of equations, including reduction-oxidation reactions • calculation involving a limiting reactant and calculation of yield <p>[4] Chemical properties:</p> <ul style="list-style-type: none"> • types of ions formed (charge, valence) • chemical inertia versus reactivity <p>[5] Periodic properties:</p> <ul style="list-style-type: none"> • atomic radius • first ionization energy • electronegativity | <p>[6] Types of compounds:</p> <ul style="list-style-type: none"> • ionic • molecular, including some polymers <p>[7] Structure :</p> <ul style="list-style-type: none"> • Linus Pauling diagram including exceptions to the octet rule and resonance (with polyatomic ions and simple organic molecules) • three-dimensional structure using the valence shell electron pair repulsion (VSEPR) theory <p>[8] Hybridization:</p> <ul style="list-style-type: none"> • types: sp, sp² and sp³ • atomic orbital overlap (σ et π). <p>[9] Physical properties:</p> <ul style="list-style-type: none"> • melting and boiling points <p>[10] Data processing:</p> <ul style="list-style-type: none"> • use of computer tools • evaluation of uncertainties • mathematical processing • graphical representation with a trend line |
|---|--|

Code: 0C02

<i>Objective</i>	<i>Standard</i>
Statement of the Competency	Performance Criteria for the Competency as a Whole
Analyze chemical systems in solutions.	• Appropriate use of terminology • Observance of mathematical and chemical formalism • Use and conversion of appropriate units of measurement • Consideration of environmental issues • Demonstration of rigour in the problem-solving approach
Elements of the Competency	Performance Criteria
1. Solve problems related to different types of solutions.	• Appropriate distinction of the different types of solutions [1] • Appropriate use of units of concentration [2] • Precise calculations involving colligative properties [3]
2. Solve problems related to the kinetics of reactions in solutions.	• Appropriate determination of a reaction rate equation • Accurate application of the integrated rate laws [4] • Consideration of energetic aspects of catalysis
3. Carry out the analysis of systems from a chemical equilibrium perspective.	• Accurate application of the law of mass action [5] • Accurate prediction of a system's evolution according to Le Chatelier's principle • Correct resolution of problems involving acid-base systems [6] • Accurate application of the concept of reduction-oxidation concept
4. Verify, using an experimental method, some properties of chemical systems and reactions.	• Appropriate use of laboratory techniques, equipment and measurement apparatus • Compliance with laboratory rules for health, safety and environmental protection • Appropriate data processing [7] • Relevance of the analysis and accuracy of the results • Communication of results according to expected requirements • Effective contribution to teamwork

Learning Activities

Discipline: Chemistry

Weighting: 2-2-2

Credits: 2

Periods of instruction: 60

Indications:

Additional information on content:

- [1] Solutions:
 - solute, solvent, water solubility, saturated solution
 - notions of electrolytes and non-electrolytes
- [2] Units of concentration:
 - mol/L, mol/kg, % m/m, % V/V, % m/V, ppm
- [3] Colligative properties:
 - ebullioscopy and cryoscopy
- [4] Integrated rate law:
 - first-order, second-order and half-life
- [5] Law of mass action:
 - equilibrium constant, reaction quotient
 - homogeneous systems: aqueous and gaseous
 - heterogeneous systems (with solid)
- [6] Acid-base systems:
 - calculation of pH
 - strong acids and strong bases
 - weak acids and weak bases
 - buffer systems
- [7] Data processing:
 - use of computer tools
 - evaluation of uncertainties
 - mathematical processing
 - graphical representation with a trend line

Code: 0C0F

<i>Objective</i>	<i>Standard</i>
Statement of the Competency	Performance Criteria for the Competency as a Whole
Analyze the structure and reactivity of organic molecules.	• Appropriate use of terminology • Demonstration of rigour in the three-dimensional representation of molecules
Elements of the Competency	Performance Criteria
1. Use the language and symbols of organic chemistry.	• Adherence to writing conventions for molecules [1] • Accurate application of nomenclature rules of organic compounds • Accurate recognition of the different types of isomerism [2] • Accurate drawing and listing of isomers • Accurate linkage of the functional groups and molecules of biological interest [3]
2. Explain the reactivity of simple organic molecules.	• Accurate distinction of the main types of organic reactions [4] • Accurate distinction of reagent types [5] • Appropriate consideration of the main electronic effects on reactivity [6] • Accurate recognition of the reactivity of the major families of organic compounds [7] • Appropriate representation of a given reaction's mechanism [8] • Consideration of the stereospecificity of certain reactions
3. Develop methods for synthesizing simple organic compounds using given reagents.	• Correct demonstration of the connections between structure, reactivity and mechanism • Realistic prediction of the products of a reaction
4. Perform the synthesis, purification and characterization of organic compounds.	• Appropriate use of laboratory techniques, equipment and analysis instruments used in organic chemistry • Compliance with laboratory rules for health, safety and environmental protection • Relevance of the analysis and accuracy of the results [9] • Communication of results according to expected requirements • Effective contribution to teamwork

Learning Activities

Discipline: Chemistry

Weighting: 2-2-2

Credits: 2

Periods of instruction: 60

Indications:

Additional information on content:

- | | |
|--|---|
| <p>[1] Conventions:</p> <ul style="list-style-type: none">• condensed• expanded• skeletal• perspective <p>[2] Types of isomerism:</p> <ul style="list-style-type: none">• constitutional isomerism• stereoisomerism <p>[3] Functional groups:</p> <ul style="list-style-type: none">• alcohol• amine• carboxylic acid• amide• ester <p>[4] Types of organic reactions:</p> <ul style="list-style-type: none">• addition• elimination• substitution <p>[5] Categories of reagents:</p> <ul style="list-style-type: none">• nucleophilic reagent• electrophilic reagent• Lewis acids and bases | <p>[6] Electronic effects:</p> <ul style="list-style-type: none">• inductive effects• resonance <p>[7] Families of organic compounds:</p> <ul style="list-style-type: none">• alkane, alkene and alkyne• alkyl halide• alcohol• aromatic <p>[8] Mechanisms studied:</p> <ul style="list-style-type: none">• electrophilic addition• elimination• S_N1 and S_N2 <p>[9] Analysis of results:</p> <ul style="list-style-type: none">• identification of the product• purity of the product• reaction yield |
|--|---|

Code: 0P01

<i>Objective</i>	<i>Standard</i>
Statement of the Competency	Performance Criteria for the Competency as a Whole
Analyze physical situations and phenomena using the fundamental laws and principles of classical mechanics.	• Appropriate use of terminology • Observance of mathematical formalism • Use and conversion of appropriate units of measurement • Clear schematic diagrams of the situation to be analyzed • Accurate distinction of physical quantities associated with classical mechanics • Demonstration of rigour in the problem-solving approach • Display of critical judgment regarding the plausibility of results
Elements of the Competency	Performance Criteria
1. Carry out the analysis of physical situations and phenomena using translational and rotational kinematics.	• Exact calculation of the physical quantities associated with kinematics • Accurate graphical determination of the physical quantities associated with kinematics • Rigorous application of kinematic concepts and equations specific to the type of motion [1] • Correct resolution of problems related to kinematics
2. Carry out the analysis of physical situations and phenomena using the laws of dynamics for translation and rotation.	• Presentation of complete and exact free-body diagrams • Exact calculation of physical quantities associated with dynamics [2] • Rigorous application of Newton's laws for bodies in motion [3] • Rigorous application of the conditions of static equilibrium for rigid bodies at rest • Correct resolution of problems related to dynamics
3. Carry out the analysis of physical situations and phenomena using conservation principles.	• Precise calculation of work and physical quantities associated with energy [4] • Rigorous application of the principle of energy conservation to systems [5] • Exact calculation of the linear momentum and the angular momentum • Rigorous application of the conservation principles of linear momentum and angular momentum to systems • Correct resolution of problems related to the conservation principles
4. Verify, using an experimental method, some laws and principles of classical mechanics.	• Appropriate use of laboratory techniques, equipment and measurement apparatus • Appropriate data processing [6] • Relevance of the analysis and accuracy of the results • Communication of results according to established requirements • Effective contribution to teamwork

Learning Activities

Discipline: Physics

Weighting: 3-2-3

Credits: 2 $\frac{2}{3}$

Periods of instruction: 75

Indications:

The compulsory content is as follows:

- [1] Types of motion studied in kinematics:
 - motion with constant acceleration in one and two dimensions
 - parabolic motion
 - uniform and uniformly accelerated circular motion
 - rigid-body rotation about a fixed axis
- [2] Physical quantities associated with dynamics:
 - gravitational force
 - contact forces
 - torque
 - centre of mass (position)
 - moment of inertia
- [3] Types of motion studied in dynamics:
 - translational motion of one or more particles
 - circular motion of one particle
 - translational motion and rigid-body rotation about a fixed axis
- [4] Physical quantities associated with energy:
 - translational and rotational kinetic energies
 - gravitational potential energy
 - elastic potential energy
 - power
- [5] Systems involving conservative and non-conservative forces
- [6] Data processing:
 - use of computer tools
 - evaluation of uncertainties
 - mathematical processing
 - graphical representation with a trend line

Code: 0P02

<i>Objective</i>	<i>Standard</i>
Statement of the Competency	Performance Criteria for the Competency as a Whole
Analyze physical situations and phenomena using the fundamental laws and principles of electricity and magnetism.	• Appropriate use of terminology • Observance of mathematical formalism • Use and conversion of appropriate units of measurement • Clear schematic diagrams of the situation to be analyzed • Accurate distinction of the physical quantities associated with electricity and magnetism • Demonstration of rigour in the problem-solving approach • Display of critical judgment regarding the plausibility of results
Elements of the Competency	Performance Criteria
1. Carry out the analysis of situations and phenomena related to electrostatics.	• Exact calculation of the physical quantities associated with electrostatics [1] • Rigorous application of the concepts, laws and principles related to electrostatics • Correct resolution of problems related to electrostatics
2. Carry out the analysis of situations and phenomena related to electrokinetics.	• Rigorous application of the laws and principles suited for analyzing the movement of charged particles in an electric field • Accurate calculation of the physical quantities associated with electric circuits [2] • Rigorous application of Kirchhoff's laws to direct current circuits [3] • Correct resolution of problems related to electrokinetics
3. Carry out the analysis of situations and phenomena related to magnetism.	• Appropriate description of the characteristics of sources of magnetic fields • Accurate calculation of the magnetic force [4] • Rigorous application of the appropriate laws and principles for the motion of charged particles in a uniform magnetic field • Accurate use of the appropriate equations connecting the magnetic field and the intensity of the electric current • Correct resolution of problems related to magnetism
4. Carry out the analysis of situations and phenomena related to electromagnetic induction.	• Accurate determination of the magnetic flux for a uniform magnetic field • Rigorous application of Faraday's law to situations related to electromagnetic induction • Accurate determination of the direction of induced electric current using Lenz's law • Correct resolution of problems related to electromagnetic induction

- | | |
|---|---|
| <p>5. Verify, using an experimental method, some laws of electricity and magnetism.</p> | <ul style="list-style-type: none"> • Appropriate use of laboratory techniques, equipment and measurement apparatus • Appropriate data processing [5] • Relevance of the analysis and accuracy of the results • Communication of results according to established requirements • Effective contribution to teamwork |
|---|---|

Learning Activities

Discipline: Physics

Weighting: 2-2-2

Credits: 2

Periods of instruction: 60

Indications:

The compulsory content is as follows:

- [1] Physical quantities associated with electrostatics:
 - electric force
 - electric field produced by charged particles at rest
 - electric potential produced by charged particles at rest
 - potential energy of a system of charged particles
- [2] Physical quantities associated with electric circuits:
 - intensity of the electric current
 - electric potential difference (voltage)
 - electrical resistance
 - capacitance of a capacitor
 - electric power provided by a seat of electromotive force
 - power dissipated by a resistor
 - energy stored in a capacitor
- [3] Electric circuits:
 - circuits containing resistors (R)
 - circuits containing resistors and capacitors (RC)
- [4] Magnetic force:
 - exerted on a charged particle
 - exerted on a wire with current flowing through it
- [5] Data processing:
 - use of computer tools
 - evaluation of uncertainties
 - mathematical processing
 - graphical representation with a trend line

Code: 0P03

<i>Objective</i>	<i>Standard</i>
Statement of the Competency	Performance Criteria for the Competency as a Whole
Analyze physical situations and phenomena using the fundamental laws and principles of waves and modern physics.	• Appropriate use of terminology • Observance of mathematical formalism • Use and conversion of appropriate units of measurement • Clear schematic diagrams of the situation to be analyzed • Accurate distinction of the physical quantities associated with waves and modern physics • Demonstration of rigour in the problem-solving approach • Display of critical judgment regarding the plausibility of results
Elements of the Competency	Performance Criteria
1. Carry out the analysis of oscillatory motion.	• Accurate determination of the characteristics of a harmonic motion • Rigorous application of the appropriate concepts, laws and principles for analyzing a harmonic motion • Summary illustration of situations involving the resonance phenomenon • Correct resolution of problems related to oscillatory motions
2. Carry out the analysis of situations related to wave phenomena.	• Accurate distinction of types of waves [1] • Accurate determination of the characteristics of waves [2] • Rigorous application of the appropriate concepts, laws and principles for analyzing phenomena involving wave propagation • Rigorous application of the appropriate concepts, laws and principles for analyzing phenomena involving interference and diffraction of waves [3] • Correct resolution of problems related to wave phenomena
3. Carry out the analysis of phenomena related to modern physics.	• Accurate description of phenomena using appropriate physics concepts • Rigorous application of the appropriate concepts, laws and principles for analyzing quantum physics phenomena • Rigorous application of the appropriate concepts, laws and principles for analyzing nuclear physics phenomena • Correct resolution of problems involving phenomena related to modern physics
4. Address environmental issues related to radiative and energy phenomena.	• Appropriate determination of thermal energy transferred by conduction and by radiation • Appropriate determination of the impact of the greenhouse effect and radiative forcing on global warming

- | | |
|---|--|
| <p>5. Verify, using an experimental method, some laws associated with waves and modern physics.</p> | <ul style="list-style-type: none"> • Appropriate use of laboratory techniques, equipment and measurement apparatus • Appropriate data processing [4] • Relevance of the analysis and accuracy of the results • Communication of results according to expected requirements • Effective contribution to teamwork |
|---|--|

Learning Activities

Discipline: Physics

Weighting: 3-2-3

Credits: 2 ½

Periods of instruction: 75

Indications:

The compulsory content is as follows:

- [1] Types of waves:
- mechanical and electromagnetic
 - travelling and standing
 - transverse and longitudinal
- [2] Characteristics of waves:
- amplitude
 - period and frequency
 - wavelength and wavenumber
 - speed of propagation
 - intensity
 - polarization
- [3] Wave interference and diffraction phenomena:
- double-slit interference
 - single-slit diffraction
- [4] Data processing:
- use of computer tools
 - evaluation of uncertainties
 - mathematical processing
 - graphical representation with a trend line

Optional Objective and Standard taken from the Science (200.B1) program

Code: 0F01

<i>Objective</i>	<i>Standard</i>
Statement of the Competency	Performance Criteria for the Competency as a Whole
Develop software programs to automate problem-solving in a scientific context.	• Appropriate use of terminology • Correct use of required software development tools • Observance of program development steps • Respect for digital ethics regarding intellectual property • Demonstration of autonomy, rigour and perseverance
Elements of the Competency	Performance Criteria
1. Plan the automation for solving of a problem.	• Appropriate recognition of the concepts involved in a problem • Accurate determination of inputs and outputs • Accurate determination of the necessary processing • Coherent decomposition of the algorithm • Preparation of appropriate test cases to validate the functioning of the program
2. Code the algorithm in the programming language.	• Logical organization of instructions [1] • Appropriate use of basic data types and arrays [2] • Accurate use of arithmetic, relational and logical expressions [3] • Adherence to programming language syntax and conventions [4] • Appropriate use of libraries [5]
3. Verify the program's operation.	• Correct tracing of program execution • Detection of operational errors • Relevance of the corrections made

Learning Activities

Discipline: Computer science

Weighting: 1-2-3

Credits: 2

Periods of instruction: 45

Indications:

Additional information on content:

- [1] Instructions containing:
 - control structures (sequential, conditional and repetitive)
 - subroutines
- [2] Basic data types of databases that can be used to represent:
 - numbers
 - Booleans
 - character strings
- [3] Basic logic operators:
 - AND
 - OR
 - NOT
- [4] Characteristics of the programming language used:
 - general usage
 - common to the sciences
 - adapted for introduction to programming in a course of 45 periods of instruction
 - can be reinvested in a university context
- [5] Libraries for:
 - use of structured files (e.g. CSV)
 - production of graphics

General Education Component

Physical Education		Code: 4EP0
Objective	Standard	
Statement of the Competency		
Analyze one's physical activity from the standpoint of a healthy lifestyle.		
Elements of the Competency	Performance Criteria	
1. Establish the relationship between one's lifestyle habits and health.	• Proper use of documentation from scientific research or the media • Recognition of the influence of social and cultural factors on the practice of physical activity • Pertinent links made between one's lifestyle habits and the impact they have on health	
2. Be physically active in a manner that promotes one's health.	• Respect for the rules specific to the physical activity practised • Respect for codes of ethics, safety rules and regulations when being physically active • Respect for one's abilities when practising physical activities	
3. Recognize one's needs, abilities and motivational factors with respect to regular and sufficient physical activity.	• Appropriate use of strategies for the quantitative and qualitative evaluation of one's physical condition • Overall assessment of one's needs and abilities in terms of physical activity • Overall assessment of one's motivational factors with respect to being sufficiently active on a regular basis	
4. Propose physical activities that promote one's health.	• Appropriate choice of physical activities according to one's needs, abilities and motivational factors • Use of clear reasoning to explain the choice of physical activity	
Learning Activities		
Discipline:	Physical Education	
Weighting:	1-1-1	
Credits:	1	

Physical Education		Code: 4EP1
Objective		Standard
Statement of the Competency		
Improve one's effectiveness when practising a physical activity.		
Elements of the Competency		Performance Criteria
1. Plan an approach to improve one's effectiveness when practising a physical activity.		- Initial assessment of one's abilities and attitudes when practising a physical activity - Statement of one's expectations and needs with respect to the ability to practise the activity - Appropriate formulation of personal objectives - Appropriate choice of the means to achieve one's objectives - Use of clear reasoning to explain the choice of physical activity
2. Use a planned approach to improve one's effectiveness when practising a physical activity.		- Respect for the rules and regulations of the physical activity - Respect for codes of ethics, safety rules and regulations when being physically active - Appropriate use of strategies for the quantitative and qualitative evaluation of one's motor skills - Periodic assessment of one's abilities and attitudes when practising a physical activity - Meaningful interpretation of progress made and the difficulties encountered in the practice of physical activity - Pertinent, periodic and proper adjustments of one's objectives or means - Appreciable improvement in one's motor skills, techniques or complex strategies required by the physical activity
Learning Activities		
Discipline:	Physical Education	
Weighting:	0-2-1	
Credits:	1	

Physical Education		Code: 4EP2
Objective		Standard
Statement of the Competency		
Demonstrate one's ability to assume responsibility for maintaining a healthy lifestyle through the continued practice of physical activity.		
Elements of the Competency		Performance Criteria
1. Plan a personal physical activity program.		• Mention of priorities according to one's needs, abilities, and motivational factors with respect to being sufficiently active on a regular basis • Proper and appropriate formulation of personal objectives • Appropriate choice of physical activity or activities to achieve personal objectives • Appropriate planning of the conditions for performing the physical activity or activities in personal program
2. Combine the elements of a regular and sufficient practice of physical activity as part of a healthy lifestyle.		• Respect for the rules and regulations of the physical activity • Respect for codes of ethics, safety rules and regulations when being physically active • Regular and sufficient practice of a physical activity while maintaining a balance between effectiveness and health-promoting factors
3. Manage a personal physical activity program.		• Appropriate choice of criteria for measuring the attainment of program objectives • Appropriate use of strategies for the quantitative and qualitative evaluation of one's physical activity • Periodic assessment of the time invested and activities practised during the program • Appropriate, periodic and proper adjustment of personal objectives or means used • Meaningful interpretation of the progress made and difficulties encountered in the practice of physical activities • Recognition of the effect of physical activity on one's lifestyle
Learning Activities		
Discipline:	Physical Education	
Weighting:	1-1-1	
Credits:	1	

Additional Information

Key Terms Used in Pre-University Programs

Program

A program is an integrated set of learning activities leading to the achievement of educational objectives based on set standards.

Aim

The aim encompasses all of the academic fields identified in a pre-university program in order to prepare students for university. As a whole, the elements of a program—i.e. the aims of college education, common competencies, goals, objectives and standards—help students meet the educational requirements of these academic fields.

Goals

The goals of a pre-university program highlight what the students should learn. Program goals contribute to program coherence, which in turn promotes the integration and transfer of learning. They are in keeping with the program-based approach in that they serve to harmonize the program-specific and the general education components, and give concrete expression to the aim of the program.

Competency

A competency is the ability to act. It includes knowledge, skills and attitudes and refers to the student's demonstrated ability to use his or her knowledge and skills in a given situation.

Objectives

The objectives of pre-university programs determine the results expected of the students. It is by attaining objectives and meeting set standards that the students master the college-level competencies that are deemed essential to successful university studies. In pre-university programs, each objective is formulated in terms of a statement of the competency and its elements.

Standard

A standard is the level of performance at which an objective is considered to be achieved. It is by attaining objectives and meeting the required standards that the students master the college-level competencies that are deemed essential to successful university studies. In pre-university programs, each standard is formulated in terms of performance criteria.

Statement of the competency

The statement of the competency specifies the overall training objective associated with a competency; it is based on expectations identified in an analysis of university education and general education needs.

Elements of the competency

The elements specify the essential components of a competency. They include only what is necessary in order to understand and develop the competency.

Performance criteria

The performance criteria define the requirements for recognition of attainment of a standard. They are not an evaluation framework per se, but may serve to develop one. Performance criteria must be taken into account in the evaluation of competency development.

Learning activities

The aspects of learning activities that the Minister can determine, in whole or in part, in a pre-university program include: the field of studies, the discipline(s), the course weighting, the number of periods of instruction, the number of credits, and such specific indications as are deemed essential.

Common objectives and standards

Common objectives and standards determine the core learning content for pursuing university studies in a given field, no matter what specialization a student may have taken.

Objectives and standards of an option

The objectives and standards of an option expose students to an academic field in order to guide them in their university course selection.

Optional objectives and standards

Optional objectives and standards may or may not be implemented by a college. They serve to develop learning activities based on local orientations.

Harmonization of Pre-University Programs and General Education

The harmonization of pre-university programs and general education is part of a lifelong learning approach that makes it easier for college-level students to switch from one pre-university program to another without having to repeat activities for which they have already obtained credit.

Additional information on the [Harmonization of Pre-University Programs and General Education](#) is available on the quebec.ca Web site.

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