

## Quebec Sec IV Science and Technology Cycle II Program

## Facile Learning Online Topics

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The Material World		Lesson-Topic
A. Properties - 3. Properties of solutions		Lessons 1 and 3
d. Concentration	iv. Determines the concentration of an aqueous solution (g/L, percentage or ppm)	L3-8,9
e. Electrolytes	i. Defines the concept of electrolyte	L3-3
g. pH scale	i. Describes the pH scale (acidity, alkalinity, neutrality, increasing and decreasing values)	L3-6
g. pH scale	ii. Determines the pH of a few common substances (e.g. distilled water, rainwater, saliva, lemon juice, cleaners)	L3-1,3
h. Electrolytic dissociation	i. Describes electrolytic dissociation	L1-1,7 / L3-1
i. Ions	i. Defines the concept of ion	L3-3
j. Electrical conductivity	i. Describes the mechanism that allows aqueous solutions to conduct electricity (electrolytic dissolution of a solute, formation of mobile ions)	L3-3
B. Changes - 3. Chemical changes		Lesson 2
e. Combustion	i. Describes the perceivable manifestations of rapid combustion (e.g. heat, light)	L2-4
e. Combustion	ii. Explains a combustion reaction using the fire triangle	L2-4
f. Photosynthesis and respiration		L2-4
g. Acid-base neutralization reaction	i. Gives examples of acid-base neutralization reactions (e.g. adding lime to neutralize the acidity of a lake)	L3-4
g. Acid-base neutralization reaction	ii. Names the products formed during acid-base neutralization (salt and water)	L3-4
g. Acid-base neutralization reaction	iii. Recognizes an acid-base neutralization using the appropriate equation	L3-4
j. Law of conservation of mass	i. Explains the law of conservation of mass during a chemical reaction	L2-8
j. Law of conservation of mass	ii. Represents the conservation of mass using the particle model	L2-4,5,6
K. Balancing chemical equations	i. Balances chemical equations	L2-7
B. Changes - 5. Transformation of energy		Lessons 2 and 7
b. Law of conservation of energy	i. Explains the law of conservation of energy qualitatively	L7-1
b. Law of conservation of energy	ii. Applies the law of conservation of energy in different contexts	L7-1
c. Energy efficiency	i. Defines the energy efficiency of a device or system as the proportion of energy consumed that is transformed into effective work	L7-1
c. Energy efficiency	ii. Explains how to improve the energy efficiency of an electrical appliance	L7-1
d. Distinction between heat and temperature	i. Describes heat as a manifestation of energy	L2-9
d. Distinction between heat and temperature	ii. Describes the relationship between heat and temperature	L2-9
C. Organization - 1. Structure of matter		Lesson 1
g. Groups and periods	i. Locates the groups and periods in the periodic table	L1-5,10

g. Groups and periods	ii. Describes the common characteristics of a group (e.g. number of valence electrons, chemical reactivity)	L1-5,10
g. Groups and periods	iii. Associates the number of electron shells in an element with the number of its period	L1-5
h. Rutherford-Bohr atomic model	i. Describes the Rutherford-Bohr atomic model	L1-12
h. Rutherford-Bohr atomic model	ii. Represents atoms using the Rutherford-Bohr model	L1-3,4
K. Lewis notation	i. Determines the number of valence electrons in an element	L1-5
K. Lewis notation	ii. Represents atoms using Lewis notation	L1-5
<b>F. Electricity and electromagnetism - 1. Electricity</b>		<b>Lessons 1 and 4</b>
a. Electrical charge	i. Associates elementary particles with their electrical charge	L1-2
a. Electrical charge	ii. Describes the behaviour of electrical charges of opposite signs or of the same sign when close together	L1-2
b. Static electricity	i. Describes static electricity as the transfer of electrons from one body to another	L4-2,3,4,5,6
c. Ohm's law	i. Qualitatively describes the relationship between voltage, resistance and current intensity in an electrical circuit	L4-8,9,10
c. Ohm's law	ii. Applies the mathematical relationship between voltage, resistance and current intensity in an electrical circuit ( $V = R \cdot I$ )	L4-11
d. Electrical circuits	i. Describes the function of different elements of an electrical circuit (e.g. the wires transmit electrons along the circuit, resistors transform electrical energy into another form of energy)	L4-7
d. Electrical circuits	ii. Describes the two types of connections in electrical circuits (series, parallel)	L4-15
d. Electrical circuits	iii. Distinguishes between alternating and direct current	L4-7
d. Electrical circuits	iv. Represents a simple electrical circuit using a diagram	L4-7
e. Relationship between power and electrical energy	i. Applies the mathematical relationship between power, voltage and current intensity in an electrical circuit ( $P = V \cdot I$ )	L4-12,13,14
e. Relationship between power and electrical energy	ii. Qualitatively describes the relationship between the power of an electrical appliance, the electrical energy it consumes and the amount of time it is in operation	L4-12,13,14
e. Relationship between power and electrical energy	iii. Applies the mathematical relationship between electrical energy consumed, the power of an electrical appliance and the amount of time it is in operation ( $E = P \cdot \Delta t$ )	L4-12,13,14
<b>F. Electricity and electromagnetism - 2. Electromagnetism</b>		<b>Lesson 5</b>
a. Magnetic field of a live wire	i. Describes the magnetic field produced by a live wire (right-hand rule)	L5-3,4
a. Magnetic field of a live wire	ii. Names ways of modifying the intensity of the magnetic field produced by a live wire (type of wire, current intensity, length of wire)	L5-3,4
b. Forces of attraction and repulsion	i. Compares the behaviour of a compass in the magnetic field of a magnet with the magnetic field created by a live wire	L5-1,2,3,4
<b>The Living World</b>		
<b>A. Diversity of life forms - 1. Ecology</b>		<b>Lesson 6</b>
e. Study of populations	i. Describes a given population (density, distribution, biological cycles)	L6-12
e. Study of populations	ii. Describes the influence of biotic or abiotic factors on the biological cycles of a population (natality, mortality, immigration, emigration)	L6-12
e. Study of populations	iii. Explains how the availability of resources in the environment affects reproduction and survival	L6-13
e. Study of populations	iv. Defines a community as a group of populations that interact	L6-14

e. Study of populations	v. Defines an ecosystem as the relationships between the individuals in a community and abiotic factors in the environment	L6-14
f. Dynamics of communities	i. Biodiversity - Defines the biodiversity of a community as the relative abundance of species it comprises	L6-13
f. Dynamics of communities	i. Biodiversity - Explains factors that affect the biodiversity of a given community	L6-13
f. Dynamics of communities	ii. Disturbances - Defines a disturbance in a community	L6-14
f. Dynamics of communities	ii. Disturbances - Explains the effects of certain factors that disturb the ecological balance (e.g. human activity, natural disasters)	L6-14
g. Dynamics of ecosystems	i. Trophic relationships - Describes the trophic levels (producers, consumers, decomposers)	L6-14,15
g. Dynamics of ecosystems	i. Trophic relationships - Explains the relationships between the trophic levels of a food web	L6-14,15
g. Dynamics of ecosystems	ii. Primary productivity - Defines primary productivity as the quantity of organic matter produced by plants in a given territory	L6-14
g. Dynamics of ecosystems	ii. Primary productivity - Explains the effects of certain factors on primary productivity (e.g. bees help pollinate fruit trees, pathogenic microorganisms hinder plant growth)	L6-14
g. Dynamics of ecosystems	iii. Material and energy flow - Describes material and energy flow in an ecosystem	L6-14,15
g. Dynamics of ecosystems	iv. Chemical recycling - Describes certain processes underlying chemical recycling (e.g. action of microorganisms and decomposers, erosion)	L6-14
<b>B. Life-sustaining processes</b>		<b>Lesson 2</b>
f. Photosynthesis and respiration	ii. Represents the photosynthesis reaction in a balanced equation	L2-4
f. Photosynthesis and respiration	iv. Represents the respiration reaction in a balanced equation	L2-4
<b>The Earth and Space</b>		
<b>A. Characteristics of the Earth - 2. Lithosphere</b>		<b>Lesson 6</b>
i. Minerals	ii. Distinguishes between minerals and ore	L6-2
i. Minerals	iii. Describes some of the environmental impacts of mining or of the transformation of minerals	L6-2
k. Soil profile (horizons)	i. Describes the structure of a soil (superimposition of layers of different compositions and thicknesses)	L6-4
k. Soil profile (horizons)	ii. Explains the chemical and biological reactivity of a soil based on its composition (e.g. oxidation, acid-base neutralization, decomposition)	L6-4
l. Permafrost	i. Defines the permafrost as a layer of permanently frozen soil	L6-4
l. Permafrost	ii. Explains some of the consequences of a rise in temperature in the permafrost (e.g. landslides, methane emissions)	L6-4
p. Biogeochemical cycle	i. Carbon cycle - Describes transformations related to the circulation of carbon (e.g. photosynthesis, plant decomposition, dissolution in water, combustion of fossil fuels)	L6-10
p. Biogeochemical cycle	ii. Nitrogen cycle - Describes transformations related to the circulation of nitrogen (e.g. nitrogen fixation, nitrification, denitrification)	L6-10
<b>A. Characteristics of the Earth - 3. Hydrosphere</b>		<b>Lesson 6</b>
b. Catchment area	i. Defines a catchment area as a territory surrounding a waterway	L6-5

b. Catchment area	ii. Describes some of the impacts of human activity on the waterways in a catchment area	L6-5
c. Salinity	i. Defines salinity as a measure of the quantity of salt in a solution	L6-5
c. Salinity	ii. Describes the influence of salinity on the density of a solution	L6-5
d. Oceanic circulation	i. Describes factors that affect the circulation of surface currents and deep currents (e.g. wind, the Earth's rotation, temperature, salinity, density)	L6-5
d. Oceanic circulation	ii. Describes the role of thermohaline circulation on global climate regulation (e.g. effect of the Gulf Stream on the climate of the east coast of North America)	L6-5
e. Glacier and ice floe	i. Distinguishes between glaciers and ice floes	L6-5
e. Glacier and ice floe	ii. Describes some of the impacts of the melting of glaciers and ice floes (e.g. increase in sea level, disturbance of thermohaline circulation)	L16-5
<b>A. Characteristics of the Earth - 4. Atmosphere</b>		<b>Lesson 6</b>
b. Greenhouse effect	i. Describes the greenhouse effect	L6-7
b. Greenhouse effect	ii. Explains some of the consequences of a higher concentration of greenhouse gases (e.g. global warming that could result in higher sea levels, disturbances in ecosystems or the melting of glaciers)	L6-7
c. Air mass	i. Describes the properties of an air mass (temperature, humidity, pressure)	L6-6
c. Air mass	ii. Explains the formation of clouds when two different air masses meet	L6-6
d. Atmospheric circulation	i. Describes the main factors responsible for atmospheric circulation (e.g. pressure variations, uneven heating of the Earth's surface)	L6-6
e. Cyclone and anticyclone	i. Explains the formation of cyclones (low-pressure areas) and anticyclones (high-pressure areas)	L6-6
<b>A. Characteristics of the Earth - 5. Climate zone</b>		<b>Lesson 6</b>
a. Factors that influence the distribution of biomes	i. Describes the geographical and climatic factors that affect the distribution of biomes (e.g. latitude, humidity, temperature, salinity)	L6-11
b. Terrestrial biomes	i. Describes different terrestrial biomes (e.g. fauna, flora, climate, type of soil)	L6-11
c. Marine biomes	i. Describes different marine biomes (e.g. fauna, flora, temperature, salinity)	L6-11
<b>B. Geological and geophysical phenomena</b>		<b>Lesson 7</b>
i. Renewable and nonrenewable energy resources	ii. Describes technologies used to produce electricity using the energy resources in the lithosphere, hydrosphere and atmosphere	L7-all
i. Renewable and nonrenewable energy resources	iii. Describes the main impact of the use of energy resources in the lithosphere, hydrosphere and atmosphere	L7-all
<b>C. Astronomical phenomena - 1. Concepts related to astronomy</b>		<b>Lesson 6</b>
b. Earth-Moon system	i. Describes the tides in terms of the gravitational effect of the Earth-Moon system	L6-9
d. Solar energy flow	i. Describes the main factors that affect the quantity of solar energy that reaches the Earth's surface (e.g. reflection and absorption of solar energy by the atmosphere or surfaces)	L6-7,8

The Technological World		
<b>B. Mechanical engineering - 3. Engineering</b>		<b>Lesson 8</b>
c. Linking of mechanical parts	i. Describes the characteristics of the links in a technical object (direct or indirect, rigid or flexible, removable or permanent, partial or complete)	L8-5
c. Linking of mechanical parts	ii. Determines the desirable characteristics of links in the design of a technical object	L8-5
c. Linking of mechanical parts	iii. Judges the choice of assembly solutions in a technical object	L8-5
e Typical functions	iii. Explains the choice of a type of link in a technical object (e.g. using a screw makes it possible to attach and remove a battery case)	L8-5
f. Guiding controls	i. Explains the choice of a type of guiding control in a technical object (e.g. the slide guides a drawer and reduces friction)	L8-5
j. Construction and characteristics of motion transformation systems	i. Explains the choice of a motion transmission system in a technical object (e.g. using a gear assembly rather than friction gears to get better engine torque and avoid slipping)	L8-4
m. Construction and characteristics of motion transformation systems	i. Explains the choice of a motion transformation system (screw gear system, cams, connecting rods, cranks, slides, rotating slider crank mechanisms, rack-and-pinion drive) in a technical object (e.g. most car jacks use a screw gear system rather than a rack-and-pinion system, because the force of the arm on the small crank provides more thrust and because, given that it is nonreversible, the system is safer)	L8-4
n Speed changes	i. Uses systems that allow for speed changes in the design of technical objects	L8-3
<b>C. Electrical engineering - 3. Engineering</b>		<b>Lessons 4 an 7</b>
a. Power supply	i. Defines power supply as the ability to generate electrical current	L4-7
a. Power supply	ii. Determines the source of current in technical objects with an electrical circuit (e.g. chemical battery, solar cell, alternator, thermocouple, piezoelectric)	L4-7
b. Conduction, insulation and protection	i. Defines conduction as the ability to conduct electricity	L4-7
b. Conduction, insulation and protection	ii. Distinguishes between electrical conductors and insulators in a technical object	L4-7
b. Conduction, insulation and protection	iii. Describes the role of a protective device in a circuit (fuse, breaker)	L4-7
b. Conduction, insulation and protection	iv. Analyzes the factors that affect electrical conductivity (section, length, nature, temperature of conductor)	L4-10
c. Control	i. Defines control as the ability to control the travel of electrical current	L4-7
c. Control	ii. Describes different types of switches (lever, pushbutton, flip-flop, magnetic control)	L4-7
d. Transformation of energy (electricity and light, heat, vibration, magnetism)	i. Associates the transformation of energy with different components of a circuit (e.g. bulbs transform electrical energy into light and heat)	L4-7
d. Transformation of energy (electricity and light, heat, vibration, magnetism)	ii. Describes the energy transformations that take place in electrical or electronic appliances (e.g. in a cell phone, electricity is transformed into light for the display and vibrations for the sound)	L7-1
<b>D. Materials - 2. Mechanical properties of materials</b>		<b>Lesson 8</b>

a. Constraints	ii. Describes the constraints to which different technical objects are subject: tension, compression, torsion, deflection, shearing (e.g. a diving board is subject to deflection)	L8-1
c. Characteristics of mechanical properties	i. Explains the choice of a material based on its properties (e.g. the malleability of aluminum makes it useful for making thin-walled containers)	L8-1
d. Types and properties	Plastics: thermoplastics and thermosetting plastics (e.g. thermoplastics are used for prostheses because of their corrosion resistance and lightness; Bakelite, a thermosetting plastic, is used to mould electrical parts because it is a good electrical insulator)	L8-2
d. Types and properties	Ceramics (e.g. ceramics are used in ovens because they are very hard and heat and wear resistant)	L8-2
d. Types and properties	Composites (e.g. carbon fibre is used for hockey sticks because of its hardness, resilience and lightness)	L8-2
e. Modification of properties	i. Describes different treatments to prevent degradation of materials (e.g. metal plating, antirust treatments, painting)	L8-2