

Operation Water Biology Curriculum Connections

- ❖ Teaches students about chlorine, chloramine, ammonia, iron, and biological water treatment (a more environmentally friendly method of treating water).
- ❖ This program is made up of 8 lesson plans (7 and 8 are optional, but suggested)
- ❖ Applies to grades 9 - 12
- ❖ Curriculum Connections last updated February 2022.

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Alberta
Grade Nine
Science

Curriculum Last Updated: 2014

Unit C: Environmental Chemistry (Social and Environmental Emphasis)

- 1: Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things
- 2: Identify processes for measuring the quantity of different substances in the environment and for monitoring air and water quality
- 3: Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment

Grade Eleven
Science

Curriculum Last Updated: 2014

Unit A: Chemical Changes

- 1: Investigate aqueous solutions to determine conductivity and to calculate concentration
- 2: Explain oxidation, reduction and spontaneity and apply this knowledge to voltaic and electrolytic cells and to industrial processes

Chemistry

Curriculum Last Updated: 2014

Unit C: Matter as Solutions, Acids and Bases

- 1: Investigate solutions, describing their physical and chemical properties

Grade Twelve
Chemistry

Curriculum Last Updated: 2014

Unit B: Electrochemical Changes

- 1: Explain the nature of oxidation-reduction reactions
- 2: Apply the principles of oxidation-reduction to electrochemical cells

British Columbia
Grade Nine
Science

Curriculum Last Updated: 2016

Big Ideas

- The biosphere, geosphere, hydrosphere, and atmosphere are interconnected, as matter cycles and energy flows through them

Content

- Matter cycles within biotic and abiotic components of ecosystems
- Sustainability of systems

Grade Ten
Science

Curriculum Last Updated: 2018

Big Ideas

- Energy change is required as atoms rearrange in chemical processes.

Content

- How do chemical processes - personal, local, or global - affect your life?
- What safety considerations need to be taken into account when dealing with chemicals?

Grade Eleven
Life Sciences

Curriculum Last Updated: 2018

Big Ideas

- Life is a result of interactions at the molecular and cellular levels

Content

- Identification of bacteria
- Through the study of viruses and bacteria, how might scientists find new and innovative ways to prevent the spread of future diseases?

Chemistry

Curriculum Last Updated: 2018

Big Ideas

- Organic chemistry and its applications have significant implications for human health, society, and the environment
- Matter and energy are conserved in chemical reactions
- Solubility within a solution is determined by the nature of the solute and the solvent

Content

- How could you measure negative and/or positive impacts of chemical reactions on human health, society, and the environment in your local community?
- How do lab techniques contribute to safety?
- How does the bent shape of the water molecule cause polarity?
- Why do some materials dissolve in water or other liquids, but others do not?

Earth Science

Curriculum Last Updated: 2018

Big Ideas

- Earth materials are changed as they cycle through the geosphere and are used as resources, with economic and environmental implications
- The distribution of water has a major influence on weather and climate

Content

- What criteria must be met for an earth material to be considered a "resource"?
- Why might water be considered Earth's most important resource?
- How is the hydrosphere connected with the geosphere and the atmosphere?

Grade Twelve

Biology

Curriculum Last Updated: 2006

A2: Design an experiment using the scientific method

- Formulate and carry out a repeatable, controlled procedure to test the hypothesis

- Observe, measure and record data
- Draw conclusions from results

A3: Interpret data from a variety of text and visual sources

- Using the data found throughout the lessons students will be able to make inferences and generalizations
- Draw and present conclusions

B2: Describe the characteristics of water and its role in biological systems

- Describe the role of water and understand the chemicals it is treated with and for
- Perform calculations involving concentration, volume and dilution factors

Chemistry

Curriculum Last Updated: 2018

Big Ideas

- Saturated solutions are systems in equilibrium
- Acid or base strength depends on the degree of ion dissociation
- Oxidation and reduction are complementary processes that involve the gain or loss of electrons

Content

- How is the solubility constant useful in studying chemical processes?
- How can ions (e.g., calcium, magnesium) be removed from hard water?
- How are the concepts of acid/base strength and acid/base concentration different?
- How are aquatic ecosystems affected by changes in pH?
- How can electrochemical and electrolytic cells be used in practical situations?
- What are some applications of redox reactions?

**Manitoba
Grade Ten
Science**

Curriculum Last Updated: 2001

Cluster 1: Dynamics of Ecosystems

- S2-1-03 Describe bioaccumulation and explain its potential impact on consumers
- S2-1-10: Investigate how human activities affect an ecosystem and use the decision-making process to propose a course of action to enhance its sustainability

**Grade Eleven
Biology**

Curriculum Last Updated: 2010

Unit 5: Protection and Control

- B11-5-02: Describe the body's response to allergens, vaccines, and viruses/bacteria

Chemistry

Curriculum Last Updated: 2006

Topic Four: Solutions

- C11-4-13: Differentiate among, and give examples of, the use of various representations of concentration
- C11-4-14: Solve problems involving calculation for concentration, moles, mass, and volume
- C11-4-15: Prepare a solution, given the amount of solute (in grams) and the volume of solution (in milliliters), and determine the concentration in moles/litre
- C11-4-16: Solve problems involving the dilution of solutions
- C11-4-17: Perform a dilution from a solution of known concentration
- C11-4-18: Describe examples of situations where solutions of known concentration are important
- C11-4-19: Describe the process of treating a water supply, identifying the allowable concentrations of metallic and organic species in water suitable for consumption

**Grade Twelve
Chemistry**

Curriculum Last Updated: 2013

Topic 1: Reactions in Aqueous Solutions

- C12-1-01: Explain examples of solubility and precipitation at the particulate and symbolic levels
- C12-1-04: Write balanced neutralization reactions involving strong acids and bases
- C12-1-08: Outline the development of scientific understanding of oxidation and reduction reactions
- C12-1-09: Determine the oxidation numbers for atoms in compounds and ions
- C12-1-10: Identify reactions as redox or non-redox
- C12-1-11: Balance oxidation-reduction reactions using redox methods
- C12-1-12: Research practical applications of redox reactions

Topic 5: Acids and Bases

- C12-5-03: Describe the relationship between the hydronium and hydroxide ion concentrations in water
- C12-5-04: Perform a laboratory activity to formulate an operational definition of pH
- C12-5-07: Distinguish between strong and weak acids and bases
- C12-5-10: Perform a laboratory activity to determine the concentration of an unknown acid or base, using a standardized acid or base
- C12-5-11: Predict whether an aqueous solution of a given ionic compound will be acidic, basic, or neutral, given the formula

New Brunswick

Grade Nine

Science

Curriculum Last Updated: 2002

Unit 2: Physical Science: Atoms and Elements

- 307-12: Investigate materials and describe them in terms of their properties
- 307-13: Describe changes in the properties of materials that result from some common chemical reactions

Grade Ten

Science

Curriculum Last Updated: 2002

Unit 1: Life Science: Sustainability of Ecosystems

- 318-1: Illustrate the cycling of matter through biotic and abiotic components of an ecosystem by tracking carbon, nitrogen, and oxygen
- 318-6: Explain how biodiversity of an ecosystem contributes to its sustainability
- 331-6: Analyze the impact of external factors on an ecosystem

Grade Eleven

Biology 111/112

Curriculum Last Updated: 2008

Unit 2: Biodiversity

- 331-6: Analyze the impact of external factors on an ecosystem

Unit 3: Maintaining Dynamic Equilibrium

- 314-1: Identify chemical elements that are commonly found in living systems
- 314-2: Identify the role of compounds, such as water, found in living systems
- 314-3: Identify and describe the structure and function of important biochemical compounds, including carbohydrates, proteins and lipids

Environmental Science 120

Curriculum Last Updated: 2012

Unit 1: An Overview of Environmental Science

- Explore and communicate current understanding of local, regional and global environmental issues
- Identify ways to measure environmentally sustainable behaviours, and describe links to economic and social factors
- Become aware of the range of issues arising from overpopulation and human activity
- Explore one or a few local or regional issues with respect to the impact on the environment, and on history, economics and social systems
- Practice research and presentation skills including experimenting to test environmental impact, identifying and accessing various organizations for information and expertise, and considering the legislation which impacts on environmental issues.
- Explore how technology is used to gather and communicate information, and to address the issues

Unit 2: Sustainable Development

- Recognize that humans are just one part of a complex system of living things, with an inordinate impact on the biosphere, often accelerated by the use of technology
- Explore how the development of technologies has affected land and water use
- Find examples of development that is sustainable and is not sustainable - ecologically, economically, socially, and culturally

Unit 3: Optional topics for Study (Fresh Water Use)

- Describe water use, locally, nationally, and globally
- Develop an understanding of the natural fresh water ecology and the impact of people
- Design and carry out an experiment to test the impact of people on fresh water ecology
- Describe ways in which we can use water more sustainably
- Contact relevant local, regional and/or national organizations and government agencies, and identify their mandate and perspective on water issues
- Demonstrate the effective and critical use of a variety of investigation and research methods

Newfoundland and Labrador Secondary Grades Biology 2201

Curriculum Last Updated: 2020

GCO 1 Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.

- 27.0 analyze natural systems to interpret and explain their structure and dynamics
- 32.0 analyze from a variety of perspectives the risks and benefits to society and the environment of applying scientific knowledge or introducing a particular technology
- 34.0 provide examples of how science and technology are an integral part of their lives and their community
- 36.0 propose courses of action on social issues related to science and technology, taking into account an array of perspectives, including that of sustainability

GCO 3 Students will construct knowledge and understandings of concepts in life science, physical science, and Earth and space science, and apply these understandings to interpret, integrate, and extend their knowledge.

- 28.0 analyze interactions within and between populations
- 33.0 evaluate Earth's carrying capacity, considering human population growth and its demands on natural resources

Environmental Science 3205

Curriculum Last Updated: 2010

Unit 1: Introduction to Environmental Science

- 1.11: Define environmental conservation
- 1.16: Recognize that environmental monitoring is an essential component of sustainability
- 1.19: Describe your community's impact on the environment
- 1.20: Describe environmental responsibility. Include the role of individuals, community, industry, and government
- 1.21: Define eco-citizenship. Include knowledge, attitude, and practice
- 1.40: Identify career opportunities related to the study of environmental issues

Unit 4: Water Use and the Environment

Curriculum Last Updated: 2010

- 4.02: Recognize that water is a finite resource
- 4.12: Identify physical, biological, and chemical impacts on water quality
- 4.13: Evaluate the impacts of human activities on the water resources. Include personal use, community use, and global use
- 4.18: List the main sources of drinking water in Newfoundland and Labrador. Include surface water, well water (dug and drilled), and "spring" water
- 4.19: Outline the risks involved in drinking untreated water. Include E-coli, giardia, hepatitis, and parasitic worms
- 4.20: Identify the main components of the multi-barrier approach to ensure safe drinking water
- 4.21: Identify the phases of treating municipal water. Include pre-treatment (screening, flocculation and sedimentation), treatment (chlorination, ozonation, ultraviolet light), and post treatment (fluoridation, water softening)
- 4.22: Describe alternate methods of water treatment. Include boiling, carbon filtering, distillation, and reverse osmosis
- 4.23: List sources of wastewater. Include municipal and industrial
- 4.24: Indicate the impacts of untreated wastewater on freshwater and marine ecosystems
- 4.25: Describe the disposal and treatment methods for municipal and industrial effluent. Include treatment plants, lagoons (containment system), constructed wetlands, septic systems, and out houses

Science 1206

Curriculum Last Updated: 2018

Unit 4: Sustainability of Ecosystems

- 68.0: Illustrate and explain the cycling of matter through biotic and abiotic components of an ecosystem by tracking carbon, nitrogen, and oxygen
- 71.0: Analyze the impact of external factors on an ecosystem

Northwest Territories

See Alberta's and Saskatchewan's Curriculum

The Northwest Territories makes use of Alberta's curriculum for K-12 math, as well as grade 7 to grade 12 sciences and social studies, physical education, and career and technology studies. It also makes use of Saskatchewan's curriculum for grade 1 to grade 9 arts education and Alberta's curriculum for high school arts education.

Nova Scotia
Grade Nine
Science

Curriculum Last Updated: 2014

Atoms and Elements

Physical and Chemical Changes

- Perform experiments, collect evidence, report findings, and demonstrate a knowledge of WHMIS standards in the laboratory (209-7, 111-6, 210-11)
- Investigate materials and describe them in terms of their physical properties (307-12)
- Describe changes in the properties of materials that result from some common chemical reactions (307-13)

Periodic Table

- Use the periodic table as a classification system and compile data about its structure (210-1, 210-2)
- Explain and provide examples of how society's needs for chemistry incorporate science, technology, and environment (112-3, 112-8)

Grade Ten
Science

Curriculum Last Updated: 2012

Life Science: Sustainability of Ecosystems

- 114-1: Question and analyze how a paradigm shift in sustainability can change society's views
- 214-1, 318-6: Describe how the classification involved in the biodiversity of an ecosystem is responsible for its sustainability
- Predict and analyze the impact of external factors on the sustainability of an ecosystem, using a variety of formats (212-4, 214-3, 331-6)
- Diagnose and report the ecosystem's response to short-term stress and long-term change (213-7, 215-1, 318-4)

Grade Eleven Chemistry

Curriculum Last Updated: 2015

Calculations and Chemical Equations

- 214-13: Identify practical problems that involve technology where equations were used
- 213-3: Use instruments effectively and accurately for collecting data
- 215-1: Communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others

Applications of Stoichiometry

- 214-12: Explain how data support or refute the hypotheses or prediction of chemical reactions
- 117-2: Analyze society's influence on science and technology

Grade Twelve Chemistry

Curriculum Last Updated: 2015

Electrochemistry

Oxidation and Reduction

- 115-1: Distinguish between scientific questions and technological problems

Concentration, Properties, and Solubility

- 213-5: Compile and organize solution data, using appropriate formats and data treatments to facilitate interpretation of solubility
- 323-6: Determine the molar solubility of a pure substance in water

Nunavut

See Alberta's Curriculum

Nunavut uses Alberta's math, science, English language arts and health curriculum.

Ontario
Grade Nine
Science Academic

Curriculum Last Updated: 2008

B. Biology: Sustainable Ecosystems

- B1: Assess the impact of human activities on the sustainability of terrestrial and/or aquatic ecosystems, and evaluate the effectiveness of courses of action intended to remedy or mitigate negative impacts
- B2: Investigate factors related to human activity that affect terrestrial and aquatic ecosystems, and explain how they affect the sustainability of these ecosystems

C. Chemistry: Atoms, Elements, and Compounds

- C1: Assess social, environmental, and economic impacts of the use of common elements and compounds, with reference to their physical and chemical properties
- C2: Investigate, through inquiry, the physical and chemical properties of common elements and compounds
- C3: Demonstrate an understanding of the properties of common elements and compounds, and of the organization of elements in the periodic table

Grade Ten
Science Academic

Curriculum Last Updated: 2008

C. Chemistry: Chemical Reactions

- C1: Analyze a variety of safety and environmental issues associated with chemical reactions, including the ways in which chemical reactions can be applied to address environmental challenges
- C2: Investigate, through inquiry, the characteristics of chemical reactions

Grade Eleven
Biology

Curriculum Last Updated: 2008

B. Diversity of Living Things

- B1: Analyze the effects of various human activities on the diversity of living things

- B2: Investigate, through laboratory and/or field activities or simulations, the principles of scientific classification, using appropriate sampling and classification techniques

Chemistry

Curriculum Last Updated: 2008

C. Chemical Reactions

- C1: Analyze chemical reactions used in a variety of applications, and assess their impact on society and the environment

E. Solutions and Solubility

- E1: Analyze the origins and effects of water pollution, and a variety of economic, social, and environmental issues related to drinking water
- E2: Investigate qualitative and quantitative properties of solutions, and solve related problems

Grade Twelve

Biology

Curriculum Last Updated: 2008

B. Biochemistry

- B2: Investigate the chemical structures, functions, and chemical properties of biological molecules involved in some common cellular processes and biochemical reactions
- B3: Demonstrate an understanding of the structures and functions of biological molecules, and the biochemical reactions required to maintain normal cellular function

C. Metabolic Processes

- C1: Analyze the role of metabolic processes in the functioning of biotic and abiotic systems, and evaluate the importance of an understanding of these processes and related technologies to personal choices made in everyday life

Prince Edward Island

Grade Nine

Science

Curriculum Last Updated: 2018

Patterns in Atoms, Elements, and Compounds

- Identify an unknown pure substance by analyzing its chemical and physical properties

Grade Ten

Science SCI431A

Curriculum Last Updated: 2019

Unit 1. Ecosystems: Sustainability of Ecosystems

- 318-1: Illustrate the cycling of matter through biotic and abiotic components of an ecosystem by tracking carbon, nitrogen, and oxygen
- 331-6: Analyze the impact of external factors on an ecosystem
- 318-6: Explain how biodiversity of an ecosystem contributes to its sustainability

Grade Twelve

Environmental Science 621A

Curriculum Last Updated: 2011

Ecological Principles

- 3.6: Conduct an experiment to measure abiotic factors of an ecosystem

Natural Resources

- 5.8: Demonstrate an understanding of sustainable water use at different levels
- 5.9: Evaluate the significance of water resources for international relations

Environmental Challenges and Successes

- 6.10: Summarize the main types, sources and effects of water pollution
- 6.11: Explain strategies that reduce air and water pollution
- 6.12: Conduct an experiment to determine water pollutants
- 6.13: Identify the types of solid domestic waste
- 6.14: Evaluate pollution management strategies from solid domestic waste on P. E. I.

- 6.15: Propose a course of action on a social issue related to waste management, taking into account human, economic, and environmental needs

Quebec
Secondary Cycle One
Science and Technology

Curriculum Last Updated: 2011

The Earth and Space

A. Characteristics of the Earth

- 3. Hydrosphere

Secondary Cycle Two
Applied Science and Technology

Curriculum Last Updated: 2011

The Earth and Space

A. Characteristics of the Earth

- 3. Hydrosphere

Science and Technology

Curriculum Last Updated: 2011

The Earth and Space

- Hydrosphere

Science and the Environment

Curriculum Last Updated: 2011

The Material World

A. Properties

- 3. Properties of solutions

The Earth and Space

A. Characteristics of the Earth

- 3. Hydrosphere

Second Year of Secondary Cycle Two Environmental Science and Technology

Curriculum Last Updated: 2011

The Material World

A. Properties

- 3. Properties of solutions

The Earth and Space

A. Characteristics of the Earth

- 3. Hydrosphere

Saskatchewan Grade Ten Science

Curriculum Last Updated: 2016

Career Investigation

- SCI10-CI1 Investigate career paths related to various branches and sub-branches of science

Climate and Ecosystem Dynamics

- SCI10-CD1 Assess the implications of human actions on the local and global climate and the sustainability of ecosystems

Chemical Reactions

- SCI10-CR1 Explore the characteristics of a variety of chemical reactions, including the role of energy changes, and applications of acids and bases

Grade Eleven Environmental Science

Curriculum Last Updated: 2017

Career Exploration

- ES20-CE1 Analyze and explore environmental science related career paths in Saskatchewan, Canada and the world

Human Population and Pollution

- ES20-HP1 Investigate technologies and processes used for mitigating and managing resource use, waste generation and pollution associated with a growing human population

Aquatic Systems

- ES20-AS1 Analyze the function and condition of freshwater aquatic systems such as rivers, streams, lakes, wetlands and watersheds
- ES20-AS2 Assess the importance of maintaining healthy water for humans and the environment

Grade Twelve

Chemistry

Curriculum Last Updated: 2017

Electrochemistry

- CH30-EC1 Investigate the chemistry of oxidation and reduction (redox) reactions

Yukon

See British Columbia's Curriculum

The British Columbia program of studies forms the basis of the Yukon curriculum.