

Alberta

Science, Grade 9

Unit C: Environmental Chemistry

- Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things
- Identify processes for measuring the quantity of different substances in the environment and for monitoring air and water quality
- Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment
- Ask questions about the relationships between and among observable variables, and plan investigations to address those questions
- Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data
- Analyze qualitative and quantitative data, and develop and assess possible explanations
- Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results
- Work collaboratively in carrying out investigations and in generating and evaluating ideas
- Show concern for safety in planning, carrying out and reviewing activities

Science 20

Unit A: Chemical Changes

A1.5k determine the concentration of diluted solutions and the quantities of a concentrated solution and of water to use when diluting.

A1.1sts explain how science and technology are developed to meet societal needs and expand human capability

A1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions

A1.4s work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results

A2.1k balance provided single-replacement reaction equations, building on knowledge from Science 10, Unit A

A2.4k define, operationally, oxidation and reduction and spontaneous and nonspontaneous reactions; i.e., loss of electrons is oxidation, gain of electrons is reduction, a spontaneous oxidation-reduction reaction produces electrical energy from chemical change, and a nonspontaneous oxidation-reduction reaction requires electrical energy to produce chemical change

A2.2sts describe applications of science and technology that have developed in response to human and environmental needs

Unit D: Changes in Living Systems

D2.1k outline the biogeochemical cycles of nitrogen, carbon, oxygen and water and, in general terms, describe their interconnectedness, building on knowledge of the hydrologic cycle

from Science 10, Unit D

D2.1sts explain that science and technology have both intended and unintended consequences for humans and the environment

Chemistry 20

C1.2k provide examples from living and nonliving systems that illustrate how dissolving substances in water is often a prerequisite for chemical change

C1.7k calculate the concentrations and/or volumes of diluted solutions and the quantities of a solution and water to use when diluting

C1.11k describe the procedures and calculations required for preparing and diluting solutions.

C1.1sts explain how science and technology are developed to meet societal needs and expand human capability

C1.2sts explain that science and technology have influenced, and been influenced by, historical development and societal needs

C1.5sts explain that the appropriateness, risks and benefits of technologies need to be assessed for each potential application from a variety of perspectives, including sustainability

C1.1s formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues

C1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions

C.4s work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results

Chemistry 30

B1.2sts explain that technological problems often require multiple solutions that involve different

designs, materials and processes and that have both intended and unintended consequences

B1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions

BC

Science, Grade 9

A1 demonstrate safe procedures

A2 perform experiments using the scientific method

A5 demonstrate scientific literacy

A6 demonstrate ethical, responsible, cooperative behaviour

A8 demonstrate competence in the use of technologies specific to investigative procedures and research

C4 describe changes in the properties of matter

Science, Grade 10

A1 demonstrate safe procedures

A2 perform experiments using the scientific method

A3 represent and interpret information in graphic form

A4 demonstrate scientific literacy

A5 demonstrate ethical, responsible, cooperative behavior

A6 describe the relationship between scientific principles and technology

A7 demonstrate competence in the use of technologies specific to investigative procedures and research

B1 Explain the interaction of abiotic and biotic factors within an ecosystem

Biology, Grade 11

A1 Demonstrate safe and correct technique for a variety of laboratory procedures

A2 Design an experiment using the scientific method

A3 Interpret data from a variety of text and visual sources

D1 Analyse the functional interrelationships of organisms within an ecosystem

E4 Evaluate the effectiveness of various antibiotics, disinfectants, or antiseptics on bacterial cultures

Biology, Grade 12

A1 Demonstrate safe and correct technique for a variety of laboratory procedures

A2 Design an experiment using the scientific method

A3 Interpret data from a variety of text and visual sources

B2 describe the characteristics of water and its role in biological systems

Chemistry, Grade 11

A1 Demonstrate appropriate safety techniques and proper use of protective equipment

A2 Demonstrate skills in measuring and in recording data

A3 Communicate results and data in clear and understandable forms

Chemistry, Grade 12

A1 demonstrate awareness that reactions occur at differing rates

A4 describe the energies associated with reactants becoming products

G1 Describe oxidation and reduction processes

H2 Describe how electrochemical concepts can be used in various practical applications

Manitoba

Chemistry, Grade 11

C11-0-U2 Demonstrate an understanding of chemical concepts.

C11-0-S1 Demonstrate work habits that ensure personal safety and the safety of others, as well as consideration for the environment.

C11-0-S2 State a testable hypothesis or prediction based on background data or on observed events.

C11-0-S3 Design and implement an investigation to answer a specific scientific question.

C11-0-S5 Collect, record, organize, and display data using an appropriate format.

C11-0-S6 Estimate and measure accurately using Système International (SI) and other standard units.

C11-0-S7 Interpret patterns and trends in data, and infer and explain relationships.

C11-0-S9 Draw a conclusion based on the analysis and interpretation of data.

C11-0-C1 Collaborate with others to achieve group goals and responsibilities.

C11-0-A1 Demonstrate confidence in their ability to carry out investigations in chemistry and to address STSE-related issues.

C11-0-A4 Be sensitive and responsible in maintaining a balance between the needs of humans and a sustainable environment.

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 millilitres), 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.

Chemistry, Grade 12

C12-0-U2 Demonstrate an understanding of chemical concepts.

C12-0-S1 Demonstrate work habits that ensure personal safety and the safety of others, as well as consideration for the environment

C12-0-S2 State a testable hypothesis or prediction based on background data or on observed events.

C12-0-S3 Design and implement an investigation to answer a specific scientific question.

C12-0-S5 Collect, record, organize and display data using an appropriate format.

C12-0-S6 Estimate and measure accurately using Système International (SI) and other standard units.

C12-0-S7 Interpret patterns and trends in data, and infer and explain relationships.

C12-0-S9 Draw a conclusion based on the analysis and interpretation of data.

C12-0-C1 Collaborate with other to achieve group goals and responsibilities.

C12-0-T1 Describe examples of the relationship between chemical principles and applications of chemistry.

C12-0-T3 Provide examples of how chemical principles are applied in products and processes, in scientific studies, and in daily life.

C12-0-A1 Demonstrate confidence in their ability to carry out investigations in chemistry.

C12-0-A4 Be sensitive and responsible in maintaining a balance between the needs of humans and a sustainable environment.

C12-1-12 Research practical applications of redox reactions.

Senior 3 Current Topics in the Sciences, Grade 11

SLO B5 Identify and demonstrate actions that promote a sustainable environment, society, and economy, both locally and globally.

SLO C1 Demonstrate appropriate scientific inquiry skills, attitudes, and practices when seeking answers to questions.

SLO C3 Demonstrate appropriate critical thinking and decision-making skills and attitudes when choosing a course of action based on scientific and technological information.

SLO C4 Employ effective communication skills and use a variety of resources to gather and share scientific and technological ideas and data.

SLO C5 Work cooperatively with others and value their ideas and contributions.

Interdisciplinary Topics in Science 40S, Grade 12

SLO B2 Recognize that decisions reflect values and consider their own values and those of others when making a decision.

SLO B4 Recommend an alternative or identify a position and provide justification.

SLO B5 Propose a course of action related to an STSE issue.

SLO B6 Reflect on the process used by themselves or others to arrive at an STSE decision.

SLO C1 Identify questions to investigate that arise from practical problems and issues.

SLO C4 Demonstrate work habits that ensure personal safety, the safety of others, and the consideration of the environment.

SLO C9 Analyse data or observations in order to draw conclusions consistent with the available results of an investigation and identify the implications of these results.

SLO C10 Identify new questions or problems that arise from an investigation.

SLO C14 Communicate information in a variety of forms appropriate to the purpose, audience and context. *Include: technical science writing (e.g., proposals, laboratory reports, research reports...); popular science writing (e.g., magazine articles, comics, short stories, poetry...).*

SLO C17 Select and use appropriate media to communication information/data/ideas.

SLO C18 Collaborate with others to achieve group goals and responsibilities.

SLO C19 Elicit, clarify and respond to questions, ideas and diverse points of view in discussions.

SLO C23 Demonstrate a continuing, more informed interest in science and science related careers and issues.

SLO C24 Be sensitive and responsible in maintaining a balance between the needs of humans and a sustainable environment.

SLO D2 Integrate knowledge from various disciplines beyond the natural science, as necessary, in order to complement and represent the scientific worldview.

New Brunswick

Chemistry, Grade 11

- appreciate the benefits that have resulted from applications based on chemical principles
- observing common separation techniques such as filtration
- performing experiments that illustrate chemical changes
- providing examples of household, commercial, and industrial processes that use physical and/or chemical changes to produce useful substances and energy
- describing the role that energy changes in chemical reactions play in living and nonliving systems
- demonstrating the proper use of SI units in computations
- develop an awareness of the importance of water as a medium of chemical change
- value the need for safe handling and disposal of chemicals
- develop an interest in the role of solutions and gases in daily life
- using a balance and volumetric glassware to prepare solutions of specified concentrations
- calculating, from empirical data, the concentration of solutions and determining mass or volume from such concentrations
- calculating, from empirical data, the concentration of diluted solutions, and the quantities of a solution and water to use when diluting
- providing examples of how solutions and solution concentrations are applied in products and processes, in scientific studies and in daily life
- investigating the application of the scientific principles of qualitative analysis in the practice of chemistry.
- develop a positive attitude towards mathematical and scientific process skills
- appreciate the importance of careful laboratory techniques and precise calculations for obtaining accurate results
- develop confidence in their ability to reason mathematically
- appreciate the need for empirical evidence when interpreting observed phenomena
- using stoichiometric and chemical principles to analyse the chemical reactions involved in various industrial and commercial products and processes.

Chemistry, Grade 12

- develop an interest in oxidation-reduction reactions that occur in everyday life
- value the contributions of the technological innovations of electrochemistry to quality of life

Newfoundland and Labrador

Chemistry 3202

- 116-3 identify examples where technologies were developed based on scientific understanding
- 116-5 describe the functioning of domestic and industrial technologies, using scientific principles
- 116-6 describe and evaluate the design of technological solutions and the way they function, using scientific principles
- 118-1 compare the risks and benefits to society and the environment of applying scientific knowledge or introducing a technology
- 213-2 carry out procedures controlling the major variables and adapting or extending procedures where required
- 213-8 select and use apparatus and materials safely
- 214-18 identify and evaluate potential applications of findings
- 215-7 evaluate individual and group processes used in planning, problem solving and decision making, and completing a task
- 322-1 define oxidation and reduction experimentally and theoretically

Nova Scotia

Chemistry 11

Stoichiometry

- Identify practical problems that involve technology where equations were used.
- Use instruments effectively and accurately for collecting data
- Communicate questions, ideas and intentions, and receive, interpret, understand, support, and respond to the ideas of others.
- Explain how data support or refute the hypotheses or prediction of chemical reactions.
- Analyse society's influence on science and technology.

Chemistry 12

Electrochemistry

- Identify questions to investigate that arise from practical problems and issues on redox
- Distinguish between scientific questions and technological problems
- Design an experiment identifying and controlling major variables

Ontario

Science, Grade 9 Academic, SNC1D

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., sampling instruments, laboratory glassware, magnifying lenses, an electroscope) and materials (e.g., ebonite rods, star charts, a ball and spring apparatus, pH paper) for particular inquiries

A1.3 identify and locate print, electronic, and human sources that are relevant to research questions

A1.4 apply knowledge and understanding of safe practices and procedures when planning investigations (e.g., appropriate techniques for handling, storing, and disposing of laboratory materials [following the Workplace Hazardous Materials Information System–WHMIS]; safe operation of electrical equipment; safe handling of biological materials), with the aid of appropriate support materials (e.g., the Reference Manual on the WHMIS website; the Live Safe! Work Smart! Website)

A1.5 conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data

A1.6 gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams

A1.7 select, organize, and record relevant information on research topics from various sources, including electronic, print, and/or human sources (e.g., Statistics Canada publications, NASA or EnerGuide websites, personal interviews), using recommended formats and an accepted form of academic documentation

A1.8 analyze and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty

A1.9 analyze the information gathered from research sources for reliability and bias

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

A1.12 use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely

B1.1 analyze, on the basis of research, how a human activity threatens the sustainability of a terrestrial or aquatic ecosystem

B2.4 plan and conduct an investigation, involving both inquiry and research, into how a human activity affects water quality

C1.1 assess the usefulness of and/or the hazards associated with common elements or compounds in terms of their physical and chemical properties

C1.2 assess social, environmental, and economic impacts of the use of common elements or compounds

C2.2 conduct an inquiry to identify the physical and chemical properties of common elements

and compounds

Science, Grade 9 Applied, SNC1P

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., soil sampling instruments, a pneumatic trough and test tubes, magnifying lenses, an electroscope) and materials (e.g., ebonite rods, star charts, oxygen testing splints, pH paper) for particular inquiries

A1.3 identify and locate print, electronic, and human sources that are relevant to research questions

A1.4 apply knowledge and understanding of safe practices and procedures when planning investigations (e.g., appropriate techniques for handling, storing, and disposing of laboratory materials [following the Workplace Hazardous Materials Information System—WHMIS]; safe operation of electrical equipment; safe handling of biological materials), with the aid of appropriate support materials (e.g., the Reference Manual on the WHMIS website; the Live Safe! Work Smart! website)

A1.5 conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data

A1.6 gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams

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A1.9 analyze the information gathered from research sources for reliability and bias

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

A1.12 use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely

B1.1 analyze, on the basis of research, how a human activity threatens the sustainability of a terrestrial or aquatic ecosystem

C1.1 analyze how the chemical and physical properties of common elements and/or simple compounds affect the use of everyday materials that contain those elements and/or compounds

C1.2 assess the social and environmental impact of the production or use of a common element or simple compound

C2.2 use an inquiry process to identify the physical and chemical properties of common elements and simple common compounds, including gaseous substances

Science, Grade 10 Academic, SNC2D

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., a microscope, laboratory glassware, an optical bench) and materials (e.g., prepared slides, an aquarium, lenses, pH paper) for particular inquiries

A1.3 identify and locate print, electronic, and human sources that are relevant to research questions

A1.4 apply knowledge and understanding of safe practices and procedures when planning investigations (e.g., appropriate techniques for handling, storing, and disposing of laboratory materials [following the Workplace Hazardous Materials Information System–WHMIS]; safe operation of optical equipment; safe handling and disposal of biological materials), with the aid of appropriate support materials (e.g., the Reference Manual on the WHMIS website; the Live Safe! Work Smart! website)

A1.5 conduct inquiries, controlling some variables, adapting or extending procedures as required, and using standard equipment and materials safely, accurately, and effectively, to collect observations and data

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A1.7 select, organize, and record relevant information on research topics from various sources, including electronic, print, and/or human sources (e.g., websites for public health organizations, federal and provincial government publications, reference books, personal interviews), using recommended formats and an accepted form of academic documentation

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A1.12 use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely

B3.1 compare and contrast biotic and abiotic characteristics of sustainable and unsustainable terrestrial and aquatic ecosystems

C1.1 analyze, on the basis of research, various safety and environmental issues associated with chemical reactions and their reactants and/or product(s)

C1.2 analyze how an understanding of the properties of chemical substances and their reactions can be applied to solve environmental challenges

C2.1 use appropriate terminology related to chemical reactions, including, but not limited to: *compounds*, *product*, and *reactant*

C2.5 plan and conduct an inquiry to identify the evidence of chemical change

Science, Grade 10 Applied, SNC2P

A1.1 formulate scientific questions about observed relationships, ideas, problems, and/or issues, make predictions, and/or formulate hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., a microscope, laboratory glassware, an optical bench) and materials (e.g., prepared slides, an aquarium, lenses, acid–base indicators) for particular inquiries

A1.3 identify and locate print, electronic, and human sources that are relevant to research questions

A1.4 apply knowledge and understanding of safe practices and procedures when planning investigations (e.g., appropriate techniques for handling, storing, and disposing of laboratory materials [following the Workplace Hazardous Materials Information System–WHMIS]; safe operation of optical equipment; safe handling and disposal of biological materials), with the aid of appropriate support materials (e.g., the Reference Manual on the WHMIS website; the Live Safe! Work Smart! website)

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A1.6 gather data from laboratory and other sources, and organize and record the data using appropriate formats, including tables, flow charts, graphs, and/or diagrams

A1.7 select, organize, and record relevant information on research topics from various sources, including electronic, print, and/or human sources (e.g., a website for a public health organization, federal and provincial government publications, reference books, personal interviews), using recommended formats and an accepted form of academic documentation

A1.8 analyze and interpret qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis, identifying possible sources of error, bias, or uncertainty

A1.9 analyze the information gathered from research sources for reliability and bias

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

A1.12 use appropriate numeric, symbolic, and graphic modes of representation, and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely

B2.2 investigate the characteristics and interactions of biotic and abiotic components of a terrestrial or aquatic ecosystem, and describe the importance of these components in a sustainable ecosystem

Biology, Grade 11, SBI3U

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries

or research

A1.2 select appropriate instruments (e.g., sampling instruments, a microscope, a stethoscope, dissection instruments) and materials (e.g., dichotomous keys, computer simulations, plant cuttings), and identify appropriate methods, techniques, and procedures, for each inquiry

A1.3 identify and locate a variety of print and electronic sources that enable them to address research topics fully and appropriately

A1.4 apply knowledge and understanding of safe laboratory practices and procedures when planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing laboratory equipment and materials and disposing of laboratory and biological materials (e.g., preserved specimens); and by using appropriate personal protection

A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data

A1.6 compile accurate data from laboratory and other sources, and organize and record the data, using appropriate formats, including tables, flow charts, graphs, and/or diagrams

A1.7 select, organize, and record relevant information on research topics from a variety of appropriate sources, including electronic, print, and/or human sources, using suitable formats and an accepted form of academic documentation

A1.8 synthesize, analyze, interpret, and evaluate qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis and whether it is consistent with scientific theory; identify sources of bias and/or error; and suggest improvements to the inquiry to reduce the likelihood of error

A1.9 analyze the information gathered from research sources for logic, accuracy, reliability, adequacy, and bias

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions with reference to scientific knowledge

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, Punnett squares), and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places or significant figures

Biology, Grade 11, UBI3C

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., sampling instruments, a microscope, a stethoscope, dissection instruments) and materials (e.g., dichotomous keys, computer simulations, plant cuttings), and identify appropriate methods, techniques, and procedures, for each inquiry

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planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing laboratory equipment and materials and disposing of laboratory and biological materials (e.g., preserved specimens); and by using appropriate personal protection

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A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions with reference to scientific knowledge

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A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, Punnett squares), and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places or significant figures

C1.1 assess some of the effects, both beneficial and harmful, of microorganisms in the environment

C1.2 analyze ethical issues related to the use of microorganisms in biotechnology

C2.4 investigate the effect of antibacterial agents on different bacterial cultures

C2.5 investigate and analyze the conditions needed by microorganisms for growth

Biology, Grade 12, SBI4U

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., dialysis tubing, glassware, sphygmomanometer) and materials (e.g., DNA models, plants, plant cuttings, molecular models), and identify appropriate methods, techniques, and procedures, for each inquiry

A1.3 identify and locate a variety of print and electronic sources that enable them to address research topics fully and appropriately

A1.4 apply knowledge and understanding of safe laboratory practices and procedures when planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing

laboratory equipment and materials and disposing of laboratory and biological materials (e.g., plants and invertebrates); and by using appropriate personal protection

A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data

A1.6 compile accurate data from laboratory and other sources, and organize and record the data, using appropriate formats, including tables, flow charts, graphs, and/or diagrams

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A1.9 analyze the information gathered from research sources for logic, accuracy, reliability, adequacy, and bias

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions with reference to scientific knowledge

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, three-dimensional molecular models), and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places or significant figures

Chemistry, Grade 11, SCH3U

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., dialysis tubing, glassware, sphygmomanometer) and materials (e.g., DNA models, plants, plant cuttings, molecular models), and identify appropriate methods, techniques, and procedures, for each inquiry

A1.3 identify and locate a variety of print and electronic sources that enable them to address research topics fully and appropriately

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A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, three-dimensional molecular models), and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places or significant figures

B1.1 analyze, on the basis of research, the properties of a commonly used but potentially harmful chemical substance (e.g., fertilizer, pesticide, a household cleaning product, materials used in electronics and batteries) and how that substance affects the environment, and propose ways to lessen the harmfulness of the substance (e.g., by reducing the amount used, by modifying one of its chemical components) or identify alternative substances that could be used for the same purpose

B1.2 evaluate the risks and benefits to human health of some commonly used chemical substances

B2.3 use an inquiry process to investigate the chemical reactions of elements with other substances

C1.2 assess the effectiveness of some applications of chemical reactions that are used to address social and environmental needs and problems

D1.1 analyze processes in the home, the workplace, and the environmental sector that involve the use of chemical quantities and calculations

D1.2 assess, on the basis of research, the importance of quantitative accuracy in industrial chemical processes and the potential impact on the environment if quantitative accuracy is not observed

E1.1 analyze the origins and cumulative effects of pollutants that enter our water systems (e.g., landfill leachates, agricultural run-off, industrial effluents, chemical spills), and explain how these pollutants affect water quality

E1.2 analyze economic, social, and environmental issues related to the distribution, purification, or use of drinking water

E2.1 use appropriate terminology related to aqueous solutions and solubility, including, but not limited to: *concentration, solubility, precipitate, ionization, dissociation, pH, dilute, solute, and solvent*

E2.2 solve problems related to the concentration of solutions by performing calculations involving moles, and express the results in various units

E2.3 prepare solutions of a given concentration by dissolving a solid solute in a solvent or by diluting a concentrated solution

E2.8 conduct an investigation to determine the concentrations of pollutants in their local treated drinking water, and compare the results to commonly used guidelines and standards

Chemistry, Grade 12, SCH4U

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., dialysis tubing, glassware, sphygmomanometer) and materials (e.g., DNA models, plants, plant cuttings, molecular models), and identify appropriate methods, techniques, and procedures, for each inquiry

A1.3 identify and locate a variety of print and electronic sources that enable them to address research topics fully and appropriately

A1.4 apply knowledge and understanding of safe laboratory practices and procedures when planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing laboratory equipment and materials and disposing of laboratory and biological materials (e.g., plants and invertebrates); and by using appropriate personal protection

A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data

A1.6 compile accurate data from laboratory and other sources, and organize and record the data, using appropriate formats, including tables, flow charts, graphs, and/or diagrams

A1.7 select, organize, and record relevant information on research topics from a variety of appropriate sources, including electronic, print, and/or human sources, using suitable formats and an accepted form of academic documentation

A1.8 synthesize, analyze, interpret, and evaluate qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis and whether it is consistent with scientific theory; identify sources of bias and/or error; and suggest improvements to the inquiry to reduce the likelihood of error

A1.9 analyze the information gathered from research sources for logic, accuracy, reliability, adequacy, and bias

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions with reference to scientific knowledge

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, three-dimensional molecular models), and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places or significant figures

F1.2 analyze health and safety issues involving electrochemistry

F2.2 conduct an inquiry to analyze, in qualitative terms, an oxidation-reduction (redox) reaction

F3.5 explain some applications of electrochemistry in common industrial processes

Chemistry, Grade 12, SCH4C

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., dialysis tubing, glassware, sphygmomanometer) and materials (e.g., DNA models, plants, plant cuttings, molecular models), and identify appropriate methods, techniques, and procedures, for each inquiry

A1.3 identify and locate a variety of print and electronic sources that enable them to address research topics fully and appropriately

A1.4 apply knowledge and understanding of safe laboratory practices and procedures when planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing laboratory equipment and materials and disposing of laboratory and biological materials (e.g., plants and invertebrates); and by using appropriate personal protection

A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data

A1.6 compile accurate data from laboratory and other sources, and organize and record the data, using appropriate formats, including tables, flow charts, graphs, and/or diagrams

A1.7 select, organize, and record relevant information on research topics from a variety of appropriate sources, including electronic, print, and/or human sources, using suitable formats and an accepted form of academic documentation

A1.8 synthesize, analyze, interpret, and evaluate qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis and whether it is consistent with scientific theory; identify sources of bias and/or error; and suggest improvements to the inquiry to reduce the likelihood of error

A1.9 analyze the information gathered from research sources for logic, accuracy, reliability, adequacy, and bias

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions with reference to scientific knowledge

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A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, three-dimensional molecular models), and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places or significant figures

B1.1 evaluate the risks and benefits to the environment of some commonly used chemical substances

B1.2 analyze, on the basis of research, applications of qualitative analysis of matter in various fields of endeavour

D1.1 analyze, on the basis of research, a technological application that is based on the oxidation-reduction (redox) reaction

D3.1 explain the concepts of oxidation and reduction in terms of the chemical changes that occur during redox reactions

E1.1 analyze processes in the home, the workplace, or the environmental sector that require an understanding of accurate chemical calculations

E2.4 solve problems involving relationships between the following variables in a chemical reaction: quantity in moles, number of particles, atomic mass, concentration of solution, and volume of solution

E2.7 use qualitative observations of a chemical reaction to identify the chemical changes, presence of limiting reagents, and the products occurring in a chemical reaction

E2.8 prepare aqueous solutions of given concentrations (e.g., concentrations expressed in grams per litre or moles per litre) by dissolving a solid solute in a solvent or by diluting a concentrated solution

F1.2 evaluate the importance of quantitative chemical analysis in assessing air and water quality

Environmental Science, Grade 11, SVN3E

A1.1 formulate relevant scientific questions about observed relationships, ideas, problems, or issues, make informed predictions, and/or formulate educated hypotheses to focus inquiries or research

A1.2 select appropriate instruments (e.g., dialysis tubing, glassware, sphygmomanometer) and materials (e.g., DNA models, plants, plant cuttings, molecular models), and identify appropriate methods, techniques, and procedures, for each inquiry

A1.3 identify and locate a variety of print and electronic sources that enable them to address research topics fully and appropriately

A1.4 apply knowledge and understanding of safe laboratory practices and procedures when planning investigations by correctly interpreting Workplace Hazardous Materials Information System (WHMIS) symbols; by using appropriate techniques for handling and storing laboratory equipment and materials and disposing of laboratory and biological materials (e.g., plants and invertebrates); and by using appropriate personal protection

A1.5 conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data

A1.6 compile accurate data from laboratory and other sources, and organize and record the data, using appropriate formats, including tables, flow charts, graphs, and/or diagrams

A1.7 select, organize, and record relevant information on research topics from a variety of appropriate sources, including electronic, print, and/or human sources, using suitable formats and an accepted form of academic documentation

A1.8 synthesize, analyze, interpret, and evaluate qualitative and/or quantitative data to determine whether the evidence supports or refutes the initial prediction or hypothesis and whether it is consistent with scientific theory; identify sources of bias and/or error; and suggest improvements to the inquiry to reduce the likelihood of error

A1.9 analyze the information gathered from research sources for logic, accuracy, reliability, adequacy, and bias

A1.10 draw conclusions based on inquiry results and research findings, and justify their conclusions with reference to scientific knowledge

A1.11 communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

A1.12 use appropriate numeric, symbolic, and graphic modes of representation (e.g., biological diagrams, three-dimensional molecular models), and appropriate units of measurement (e.g., SI and imperial units)

A1.13 express the results of any calculations involving data accurately and precisely, to the appropriate number of decimal places or significant figures

B1.1 propose possible solutions, on the basis of research, to a current practical environmental problem that is caused, directly or indirectly, by human activities

B2.3 plan and conduct an inquiry, using appropriate technology, to compare water quality in natural and disturbed environments

B3.5 explain the effects of human activity on an aquatic or terrestrial ecosystem

C1.1 assess, on the basis of research, the effects on human health of a significant environmental phenomenon

C1.2 analyze how environmental contaminants can affect the health of different populations in Canada

C2.2 investigate, using a research process, and report on an environmental factor that can have an impact on human health

C3.1 describe common environmental factors, including pollution and environmental contaminants

E1.2 analyze, on the basis of research, the impact that an environmental contaminant, parasite, or bacteria has on the sustainability of a natural resource in Canada

Prince Edward Island

Science, Grade 10, 421A

116-1 identify examples where scientific understanding was enhanced or revised as a result of human invention of a technology

116-3 identify examples where technologies were developed on the basis of scientific understanding

116-5 describe the functioning of domestic and industrial technologies, using scientific principles

117-1 compare examples of how society influences science and technology

117-5 provide examples of how science and technology are an integral part of their lives and community

118-1(2) compare and analyze the risks and benefits to society and the environment of applying scientific knowledge or introducing a new technology

118-9 propose a course of action on social issues related to science and technology, taking into account human and environmental needs
212-3 design an experiment, identifying and controlling major variables
212-4 state a prediction and a hypothesis based on available evidence and background information
213-2 carry out procedures controlling the major variables and adapting or extending procedures where required
213-5 compile and organize data, using appropriate formats and data treatments to facilitate interpretation of the data
215-1 communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others
215-6 work co-operatively with team members to develop and carry out a plan, and troubleshoot problems as they arise

Science, 431A

116-3 Identify examples where technologies were developed based on scientific understanding.
116-5 Describe the functioning of domestic and industrial technologies using scientific principles.
117-1 Compare examples of how society influences science and technology.
117-5 Provide examples of how science and technology are an integral part of their lives and community.
118-1 Compare the risks and benefits to the biosphere of applying new scientific knowledge and technology to industrial processes.
212-3 Design an experiment identifying and controlling major variables.
212-8 Evaluate and select appropriate instruments for collecting evidence and appropriate processes for problem solving, inquiring, and decision-making.
213-2 Carry out procedures controlling the major variables and adapting or extending procedures where required.
213-5 Compile and organize data, using appropriate formats and data treatments to facilitate interpretation of the data.
214-5 Interpret patterns and trends in data, and infer or calculate linear and nonlinear relationships among variables.
215-1 Communicate questions, ideas, and intentions and receive, interpret, understand, support, and respond to the ideas of others with respect to environmental attitudes.
215-6 Work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise.

Chemistry, 521A

212-3 design an experiment identifying and controlling major variables
212-4 state a prediction and a hypothesis based on available evidence and background information
213-3 use instruments effectively and accurately for collecting data
213-4 estimate quantities

215-1 communicate questions, ideas, and intentions, and receive, interpret, understand, support, and respond to the ideas of others

Chemistry, 621A

115-5 analyze why and how a particular technology was developed and improved over time

116-4 analyze and describe examples where technologies were developed based on scientific understanding

116-6 describe and evaluate the design of technological solutions and the way they function, using scientific principles

212-3 design an experiment identifying and controlling major variables

212-8 evaluate and select appropriate instruments for collecting evidence and appropriate processes for problem solving, inquiring, and decision making

213-1 implement appropriate sampling procedures

213-2 carry out procedures controlling the major variables and adapting or extending procedures where required

212-3 design an experiment identifying and controlling major variables

213-5 compile and organize data, using appropriate formats and data treatments to facilitate interpretation of data

214-7 compare theoretical and empirical values and account for discrepancies

214-18 identify and evaluate potential applications of findings

215-6 work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise

322-1 define oxidation and reduction experimentally and theoretically

Quebec

General Biology

- To show that an ecosystem is a group of interacting components (Module II: Balance in Nature)
- To show that the interactions among living and non-living things are regulating mechanisms that exist within an ecosystem (Module II: Balance in Nature)
- To show that interactions among living things are regulating mechanisms that exist within an ecosystem (Module II: Balance in Nature)
- To show that certain regulating mechanisms are necessary to maintain a balanced ecosystems (Module II: Balance in Nature)
- To associate quality of life with a well-balanced organism and a stable ecosystem (Module II: Balance in Nature)

Ecology

Module 5: Environmental Influences on Living Organisms

Saskatchewan

Science, Grade 10

CR1 – Observe common chemical reactions in your world

- Provide examples of how science and technology are an integral part of our lives and community
- Identify indicators that provide evidence that a chemical reaction has likely taken place.
- Show concern for safety and accept the need for rules and regulations when conducting scientific investigations.
- Use scientific principles to describe the functioning of domestic or industrial technologies.
- Identify examples of technologies or technological processes that were developed based on

Biology 20

Unit 1

- 1.2 Exhibit a curiosity about life and the conditions which support life.
- 1.3 Appreciate the nature of scientific investigations and the findings of science.
- 1.4 Recognize the relationship between what is studied in biology and daily life.

Chemistry 20

Unit 1: Introduction to Chemistry

- Discuss how advances in chemistry have led to the development of new products.
- Outline the societal impact of new chemical products.
- Recognize that advances in chemistry are often driven by societal needs.
- Explain the relationship between science and technology.
- Identify some issues or problems for which a knowledge of chemistry is important in identifying causes and solutions.
- Understand how application of chemical principles through technology influences the natural environment.
- Establish arguments based on human rights, human needs or the needs of the environment with respect to the use of knowledge about chemical principles.
- Explore how moral principles influence judgments about the application of chemical principles.
- Cooperate with each other in order to enhance understanding through shared information.
- Move from choosing among teacher-directed activities toward creating self-directed activities pertinent to chemistry.
- Develop a willingness to take risks as independent learners.
- Recognize the inevitability of profound change due to technological innovations and changes in society's values and norms.
- Be willing to try to influence change by continuing to learn and apply what is learned.

Unit III: Independent Research

- Follow guidelines for completing a specific learning task.
- Participate in scientific inquiry.
- Collaborate with teachers and others to determine and monitor their own learning processes. -

Work cooperatively with others.

-Share the results of their research project with other students, teachers, parents, or members of the community.

Unit VI: Chemical Reactions

-Identify changes which indicate that a chemical reaction has taken place

-Identify chemical reactions that help maintain living organisms.

-Identify chemical reactions that harm living organisms.

-Identify chemical reactions that affect the environment.

-Record, discuss and compare their observations of reactions with others.

-Present findings about reactions by using diagrams, models, analogies or other devices.

-Strengthen perceptual abilities through concrete experiences with chemical reactions.

Chemistry 30

Unit III: Independent Research

-Follow guidelines for completing a specific learning task.

-Participate in scientific inquiry.

-Collaborate with teachers and others to determine and monitor their own learning processes. -

Work cooperatively with others.

-Share the results of their research project with other students, teachers, parents, or members of the community.

Unit V: Solubility and Solutions

-Manipulate the relationship which links the mass of solute, volume of solution and concentration of solution so that given two, the other can be determined.

-Describe how to prepare standard solutions and serial dilutions in the laboratory.

-Manipulate the relationship which links original concentration, volume of diluent and concentration of diluted solution so that given two, the other may determined.

-Investigate the application of the principles of solubility.

-Analyze data to create hypotheses, predictions and estimates.