

# Science 10F Curriculum Outcomes

112 Total Outcomes

## Topic 1: Reproduction

- S1-1-01 Illustrate and explain the process of mitotic cell division in plants and animals.  
*Include: chromosomes, mitosis, cytoplasmic division, cell cycle.*
- S1-1-02 Observe and explain the dynamic nature of cell division.
- S1-1-03 Describe various types of asexual reproduction that occur in plant and animal species.  
*Examples: fission, budding, sporulation, vegetative propagation, regeneration...*
- S1-1-04 Investigate and describe agricultural applications of asexual reproduction.  
*Examples: cloning, cuttings, grafting, bulbs...*
- S1-1-05 Illustrate and explain the production of male and female gametes by meiosis in plants and animals.
- S1-1-06 Compare and contrast the function of mitosis to that of meiosis.  
*Include: diploid cells, haploid cells*
- S1-1-07 Compare sexual and asexual reproduction in terms of their advantages and disadvantages for plant and animal species.
- S1-1-08 Investigate and explain adaptations of plant and animal species which enhance reproductive success.  
*Examples: appearance, behaviour, number of gametes or offspring, chemical cues...*
- S1-1-09 Describe the structure and function of the male and female human reproductive systems.  
*Include: role of hormones.*
- S1-1-10 Outline human development from conception through birth.  
*Include: X and Y chromosomes, zygote, embryo, fetus.*
- S1-1-11 Observe, collect, and analyze class data of single trait inheritance.  
*Examples: hand clasping, earlobe attachment, tongue rolling...*
- S1-1-12 Differentiate between dominant and recessive traits.  
*Include: genotype and phenotype*
- S1-1-13 Describe the relationships among DNA, chromosomes, genes, and the expression of traits.  
*Include: genetic similarity among all humans.*
- S1-1-14 Explain the inheritance of sex-linked traits in humans and use a pedigree to track the inheritance of a single trait.  
*Examples: colour-blindness, hemophilia...*
- S1-1-15 Investigate and describe environmental factors and personal choices that may lead to a genetic mutation or changes in an organism's development.  
*Examples: fetal exposure to alcohol, overexposure to sunlight, toxins, hormone mimics, food additives, radiation...*
- S1-1-16 Investigate Canadian and international contributions to research and technological development in the field of genetics and reproduction.  
*Example: Human Genome Project*
- S1-1-17 Discuss current and potential applications and implications of biotechnologies including their effects upon personal and public decision making.  
*Include: genetic engineering, cloning, Human Genome Project, DNA fingerprinting.*
- S1-1-18 Use the decision-making process to address a current biotechnology issue.

**18 Outcomes**

## Topic 2: Atoms and Elements

- S1-2-01 Describe how historical ideas and models have furthered our understanding of the nature of matter.  
**Include:** *Greek ideas, alchemy, Lavoisier.*
- S1-2-02 Investigate the historical progression of the atomic model.  
**Include:** *Dalton, Thomson, Rutherford, Bohr, and quantum model.*
- S1-2-03 Define element and identify symbols of some common elements.  
**Include:** *the first 18 elements and K, Ca, Fe, Ni, Cu, Zn, I, Ag, Sn, Au, W, Hg, Pb, U.*
- S1-2-04 Explain the atomic structure of an element in terms of the number of protons, electrons, and neutrons and explain how these numbers define atomic number and atomic mass.
- S1-2-05 Assemble or draw Bohr atomic models for the first 18 elements and group them according to the number of outer shell electrons.
- S1-2-06 Investigate the development of the periodic table as a method of organizing elements.  
**Include:** *periods, families (groups).*
- S1-2-07 Investigate the characteristic properties of metals, non-metals, and metalloids and classify elements according to these properties.  
**Examples:** *ductility, conductivity of heat and electricity, lustre, reactivity...*
- S1-2-08 Relate the reactivity and stability of different families of elements to their atomic structure.  
**Include:** *alkali metals, alkaline earths, chalcogens, halogens, noble gases.*
- S1-2-09 Compare elements to compounds.  
**Include:** *atoms, molecules*
- S1-2-10 Interpret chemical formulas of elements and compounds in terms of the number of atoms of each element.  
**Examples:** *He, H<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>O, CO<sub>2</sub>, NH<sub>3</sub>...*
- S1-2-11 Investigate properties of substances and explain the importance of knowing these properties.  
**Examples:** *usefulness, durability, safety...*
- S1-2-12 Differentiate between physical and chemical changes
- S1-2-13 Experiment to determine indicators of chemical change.  
**Examples:** *colour change, production of heat and/or light, production of a gas or precipitate or new substance...*
- S1-2-14 Investigate technologies and natural phenomena that demonstrate chemical change in everyday situations.  
**Examples:** *photography, rusting, photosynthesis, combustion, baking...*

## 14 Outcomes

### Topic 3: The Nature of Electricity

- S1-3-01 Demonstrate evidence for the existence of two types of charge.
- S1-3-02 Discuss early models of electricity to support the premise that models in science change.  
**Include:** *one-fluid model, two-fluid model, particle model.*
- S1-3-03 Explain how a discrepant event can be used to evaluate the particle model of electricity.  
**Include:** *the attraction of neutral objects to charged objects.*
- S1-3-04 Relate the particle model of electricity to atomic structure.
- S1-3-05 Investigate and explain electrostatic phenomena using the particle model of electricity.  
**Include:** *conservation of charge, conduction, grounding, attraction of a neutral insulator, induction.*
- S1-3-06 Investigate common electrostatic technologies and phenomena and describe measures which reduce dangers associated with electrostatics.  
**Examples:** *photocopying, static straps to reduce charge buildup, lightning, electrostatic spraypainting, electrostatic precipitator...*
- S1-3-07 Construct one or more electrostatic apparatus and explain how they function using the particle model of electricity.  
**Include:** *pieplate electrophorus.*
- S1-3-08 Demonstrate and explain the like nature of electrostatics and current electricity.  
**Include:** *discharge an electrophorus through a neon bulb.*
- S1-3-09 Define electric current as charge per unit time and solve related problems.  
**Include:**  $I = \frac{Q}{t}$ .
- S1-3-10 Define voltage (electric potential difference) as the energy per unit charge between two points along a conductor and solve related problems.  
**Include:**  $V = \frac{E}{Q}$
- S1-3-11 Identify the five sources of electrical energy and some associated technologies.  
**Include:** *chemical, photo, thermo, electromagnetic, piezo.*
- S1-3-12 Describe resistance in terms of the particle model of electricity.
- S1-3-13 Construct electric circuits using schematic diagrams.  
**Include:** *series, parallel.*
- S1-3-14 Use appropriate instruments and units to measure voltage (electric potential difference), current, and resistance.
- S1-3-15 Compare and contrast voltage (electric potential difference) and current in series and parallel circuits.  
**Include:** *cells, resistance.*
- S1-3-16 Investigate and describe qualitatively the relationship among current, voltage (electric potential difference), and resistance in a simple electric circuit.
- S1-3-17 Relate the energy dissipated in a circuit to the resistance, current, and brightness of bulbs.
- S1-3-18 Explain the parallel circuits, the components, and the safety aspects of household wiring.  
**Include:** *switches, fuses, circuit breakers, outlets.*
- S1-3-19 Explain safety considerations of some common household appliances.  
**Examples:** *kettle, heater, toaster...*

- S1-3-20 Define electrical power as energy per unit time, and solve related problems.  
**Include:**  $P = \frac{E}{t}$  domestic power consumption costs, and solve related problems.
- S1-3-21 Develop a formula for domestic power consumption costs, and solve related problems.  
**Include:**  $\text{Cost} = \frac{\text{Power} \times \text{time} \times \text{unit price}}{\text{kWh}}$
- S1-3-22 Analyze the electrical energy consumption of a household appliance.  
**Include:** calculate consumption using *Energuide* labels, read hydro meter, interpret monthly hydro bill.
- S1-3-23 Recognize and explain the importance of incorporating principles of electrical energy conservation into the decision making process.
- S1-3-24 Use the decision-making process to address an issue associated with the generation and transmission of electricity in Manitoba.  
**Include:** hydroelectric power, Sustainability

## 24 Outcomes

## Topic 4: Exploring the Universe

- S1-4-01 Use a coordinate system to locate visible celestial objects, and construct an astrolabe to determine the position of these objects.  
**Include:** *altitude, azimuth.*
- S1-4-02 Observe the motion of visible celestial objects and organize collected data.  
**Examples:** *graph sunrise and sunset data, track the position of the Moon and planets over time, maintain a log of changes in the night sky...*
- S1-4-03 Investigate how various cultures used knowledge of the position and motion of visible celestial objects for navigation.  
**Example:** *Aboriginal ceremonies linked to seasonal star positions...*
- S1-4-04 Compare and contrast historical perspectives on the relationship between Earth and space.  
**Include:** *geocentric model, heliocentric model.*
- S1-4-05 Explain the apparent motion of the Sun, stars, planets, and the Moon as seen from Earth.  
**Include:** *daily rising and setting, seasonal constellations, retrograde motion.*
- S1-4-06 Differentiate between units of measure used for astronomical distances, and perform simple calculations using these units.  
**Include:** *astronomical unit, light-year.*
- S1-4-07 Compare and contrast scientific and cultural perspectives on the origin and evolution of the universe.
- S1-4-08 Differentiate between the major components of the universe.  
**Include:** *planets, moons, comets and asteroids, nebulae, stars, galaxies, black holes.*
- S1-4-09 Explain how various technologies have extended our ability to explore and understand space.  
**Examples:** *robotics, Canadarm, Hubble telescope, Lunar Rover, shuttle, space station, Sojourner Rover, Pathfinder, and Galileo space probes...*
- S1-4-10 Investigate ways in which Canada participates in space research and in international space programs, and then use the decision-making process to address a related issue.  
**Examples:** *International Space Station, Canadarm...*
- S1-4-11 Evaluate the impact of space science and technologies in terms of their benefits and risks to humans.  
**Examples:** *search for extraterrestrial life and habitat, remote sensing, predictions of potentially catastrophic impacts, colonization of space by only a few countries...*

## 11 Outcomes

## Skills and Attitudes

### Initiating

- S1-0-1a Propose questions that could be tested experimentally
- S1-0-1b Select and justify various methods for finding the answers to specific questions
- S1-0-1c Identify STSE issues which could be addressed
- S1-0-1d Identify stakeholders and initiate research related to and STSE issue

### Researching

- S1-0-2a Select and integrate information obtained from a variety of sources  
**Include:** *print and electronic sources, specialists, and other resource people.*
- S1-0-2b Evaluate the reliability, bias, and usefulness of information.
- S1-0-2c Summarize and record information in a variety of forms  
**Include:** *paraphrasing, quoting relevant facts and opinions, proper referencing of sources.*
- S1-0-2d Review effects of past decisions and various perspectives related to an STSE issue.  
**Examples:** *governments', public environmentalists', and First Nations positions on hydroelectric development; religious, social and medical views of genetic screening...*

### Planning

- S1-0-3a State a testable hypothesis or prediction based on background data or on observed events
- S1-0-3b Identify probable mathematical relationships between variables.  
**Examples:** *relationship between current and resistance...*
- S1-0-3c Plan an investigation to answer a specific scientific question.  
**Include:** *materials, variables, controls, methods, safety considerations.*
- S1-0-3d Summarize relevant data and consolidate existing arguments and positions related to an STSE issue.
- S1-0-3e Determine criteria for the evaluation of an STSE decision.  
**Examples:** *scientific merit; technological feasibility; social, cultural, economic, and political factors; safety; cost; sustainability...*
- S1-0-3f Formulate and develop options which could lead to and STSE decision.

### Implementing a Plan

- S1-0-4a Carry out procedures that comprise a fair test.  
**Include:** *controlling variables, repeating experiments to increase accuracy and reliability of results.*
- S1-0-4b Demonstrate work habits that ensure personal safety, the safety of others, as well as consideration for the environment.  
**Include:** *knowledge and use of relevant safety precautions, WHMIS regulations, emergency equipment.*
- S1-0-4c Interpret relevant WHMIS regulations.  
**Include:** *symbols, labels, Material Safety Data Sheet(s) (MSDS).*
- S1-0-4d Use various methods for anticipating the impacts of different options.  
**Examples:** *test run, partial implementation, simulation, debate...*
- S1-0-4e Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise.
- S1-0-4f Assume the responsibilities of various roles within a group and evaluate which roles are most appropriate for given tasks.

### **Observing, Measuring, Recording**

- S1-0-5a Select and use appropriate methods and tools for collecting data or information.
- S1-0-5b Estimate and measure accurately using Système International (SI) and other standard units.  
*Include: SI conversion.*
- S1-0-5c Record, organize, and display data using an appropriate format.  
*Include: labeled diagrams, graphs, information technology.*
- S1-0-5d Evaluate, using predetermined criteria, different STSE options leading to a possible decision.  
*Include: scientific merit; technological feasibility; social, cultural, economic, and political factors; safety; cost; sustainability.*

### **Analyzing and Interpreting**

- S1-0-6a Interpret patterns and trends in data, and infer and explain relationships.
- S1-0-6b Identify and suggest explanations for discrepancies in data.  
*Examples: sources of error...*
- S1-0-6c Evaluate the original plan for an investigation and suggest improvements.  
*Examples: identify strengths and weaknesses of data collection methods used...*
- S1-0-6d Adjust STSE options as required once their potential effects become evident.

### **Concluding and Applying**

- S1-0-7a Draw a conclusion that explains the results of an investigation.  
*Include: cause and effect relationships, alternative explanations, supporting or rejecting the hypothesis or prediction.*
- S1-0-7b Select the best option and determine a course of action to implement and STSE decision.
- S1-0-7c Implement an STSE decision and evaluate its effects.
- S1-0-7d Reflect on the process used to arrive at or to implement an STSE decision, and suggest improvements.
- S1-0-7e Reflect on prior knowledge and experiences to develop new understanding.

### **Reflecting on Science and Technology**

- S1-0-8a Distinguish between science and technology.  
*Include: purpose, procedures, products.*
- S1-0-8b Explain the importance of using precise language in science and technology.
- S1-0-8c Describe examples of how scientific knowledge has evolved in light of new evidence, and the role of technology in this evolution.
- S1-0-8d Describe examples of how technologies have evolved in response to changing needs and scientific advances.
- S1-0-8e Discuss how peoples of various cultures have contributed to the development of science and technology.
- S1-0-8f Relate personal activities and possible career choices to specific science disciplines.
- S1-0-8g Discuss social and environmental effects of past scientific and technological endeavours.

## **Demonstrating Scientific and Technological Attitudes and Habits of Mind**

- S1-0-9a Appreciate and respect that science and technology have evolved from different views held by women and men from a variety of societies and cultural backgrounds.
- S1-0-9b Express interest in a broad scope of science- and technology-related fields and issues.
- S1-0-9c Demonstrate confidence in their ability to carry out investigations in science and to address STSE issues.
- S1-0-9d Value skepticism, honesty, accuracy, precision, perseverance, and open-mindedness as scientific and technological habits of mind.
- S1-0-9f Demonstrate personal involvement and be proactive with respect to STSE issues.

## **45 Outcomes**