BIG IDEAS

DNA is the basis for the diversity of living things.	Energy change is required as atoms rearrange in **chemical processes**.	**Energy** is conserved, and its transformation can affect living things and the environment.	The formation of the **universe** can be explained by the big bang theory.

Learning Standards

Curricular Competencies

Students are expected to be able to do the following:

Questioning and predicting

- Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal interest
- Make observations aimed at identifying their own questions, including increasingly complex ones, about the natural world
- Formulate multiple hypotheses and predict multiple outcomes

Planning and conducting

- Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)
- Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods and those of others
- Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data
- Ensure that safety and ethical guidelines are followed in their investigations

Processing and analyzing data and information

- Experience and interpret the local environment
- Apply **First Peoples perspectives and knowledge**, other **ways of knowing**, and local knowledge as sources of information
- Seek and analyze patterns, trends, and connections in data, including describing relationships between variables (dependent and independent) and identifying inconsistencies

Content

Students are expected to know the following:

- **DNA structure and function**
- **patterns of inheritance**
- mechanisms for the diversity of life:
  - **mutation** and its impact on evolution
  - **natural selection** and **artificial selection**
- **applied genetics** and **ethical considerations**
- rearrangement of atoms in **chemical reactions**
- acid-base chemistry
- law of conservation of mass
- **energy change** during chemical reactions
- **practical applications and implications of chemical processes**, including First Peoples knowledge
- **nuclear energy** and **radiation**
- law of conservation of energy
- **potential** and **kinetic** energy
- **transformation of energy**
- local and global **impacts of energy transformations** from technologies
- formation of the universe:
  - big bang theory
  - **components of the universe over time**
- **astronomical data and collection methods**

Learning Standards (continued)

Curricular Competencies	Content
• Construct, analyze, and interpret graphs (including interpolation and extrapolation), models, and/or diagrams • Use knowledge of scientific concepts to draw conclusions that are consistent with evidence • Analyze cause-and-effect relationships **Evaluating** • Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions • Describe specific ways to improve their investigation methods and the quality of the data • Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled • Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and secondary sources • Consider the changes in knowledge over time as tools and technologies have developed • Connect scientific explorations to careers in science • Exercise a healthy, informed skepticism and use scientific knowledge and findings to form their own investigations and to evaluate claims in secondary sources • Consider social, ethical, and environmental implications of the findings from their own and others' investigations • Critically analyze the validity of information in secondary sources and evaluate the approaches used to solve problems **Applying and innovating** • Contribute to care for self, others, community, and world through individual or collaborative approaches • Transfer and apply learning to new situations	

Learning Standards (continued)

Curricular Competencies	Content
• Generate and introduce new or refined ideas when problem solving • Contribute to finding solutions to problems at a local and/or global level through inquiry • Consider the role of scientists in innovation **Communicating** • Formulate physical or mental theoretical models to describe a phenomenon • Communicate scientific ideas, claims, information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations • Express and reflect on a variety of experiences, perspectives, and worldviews through **place**	

Big Ideas – Elaborations

- **DNA:**
  Sample questions to support inquiry with students:
  - How does DNA result in biodiversity?
  - How is the structure of DNA related to the function of DNA?
  - How do mutations occur?
- **chemical processes:**
  Sample questions to support inquiry with students:
  - In what ways do atoms rearrange during reactions?
  - How is energy involved in chemical processes?
  - How do chemical processes — personal, local, or global — affect your life?
  - What safety considerations need to be taken into account when dealing with chemicals?
- **Energy:**
  Sample questions to support inquiry with students:
  - Where does energy come from and what happens to it?
  - How does energy in the form of radiation affect living things?
  - How do energy transformations affect the environment?
- **universe:**
  Sample questions to support inquiry with students:
  - What evidence supports the big bang theory?
  - How could you model the formation of the universe?
  - How has the advancement of technology deepened our understanding of the universe?

SCIENCE – Provincial Core Curriculum
Grade 10

Curricular Competencies – Elaborations

- **Questioning and predicting:**
  Sample questions to support inquiry with students:
  - How would you determine whether characteristics are genetically inherited?
  - Why do materials need different amounts of energy to start reacting?
  - Why do some roller coasters go faster than others?
  - How would you investigate the age of the universe?

- **Planning and conducting:**
  Sample questions to support inquiry with students:
  - How would you gather genetic data to study certain traits?
  - What tools are needed to measure the energy absorbed or released in a chemical reaction?
  - How would you design a roller coaster to test a variable?
  - What criteria could be used to select the appropriate instruments for different astronomical investigations?
- **Processing and analyzing data and information:**
  Sample questions to support inquiry with students:
  - How would you use genetic data to predict traits of offspring?
  - How can you graphically compare the pH of various substances?
  - What variables would affect a roller coaster's speed?
  - How can you use multiple sources of data to support theories or conclusions about the universe?
- **First Peoples perspectives and knowledge:**
  Sample questions to support inquiry with students:
  - How has the diversity of plants in your local area benefited First Peoples?
  - How are First Peoples traditional medicines prepared in your local area?
  - How would you safely determine the efficacy of a First Peoples traditional medicine?
  - How are First Peoples traditional medicines prepared for different uses?
  - How would you design a garden for your school that features local plants and considers appropriate plant choices?
- **ways of knowing:** "Ways of knowing" refers to the various beliefs about the nature of knowledge that people have. They can include, but are not limited to, First Peoples, gender-related, subject/discipline-specific, cultural, embodied, and intuitive beliefs about knowledge.
- **Evaluating:**
  Sample questions to support inquiry with students:
  - How can the probability of specific genetic traits in individuals be determined?
  - How could you reduce the sources of error when measuring energy change in a reaction?
  - What factors would you change to increase a roller coaster's speed? Would it be appropriate to go faster?
  - How can you use multiple sources to demonstrate bias and assumptions in astronomical investigations?
- **Applying and innovating:**
  Sample questions to support inquiry with students:
  - How can you use what you know about genetics to make a game or activity to help other students learn about heredity?
  - How would you design an emergency response plan for a chemical spill in your area?

Curricular Competencies – Elaborations

  - How would you build a cart for a roller coaster that has as little friction as possible?
  - How are new technologies being used to extend the reach of human investigations into space?
- **Communicating:**
  Sample questions to support inquiry with students:
  - How would you prepare for a debate on the pros and cons of genetically modified organisms?
  - How would you best present the effects of adding industrial waste water to an aquatic ecosystem to different stakeholders?
  - How would you promote a roller coaster design based on scientific evidence?
  - How can you create a model that clearly communicates your knowledge about the universe?
- **place:** Place is any environment, locality, or context with which people interact to learn, create memory, reflect on history, connect with culture, and establish identity. The connection between people and place is foundational to First Peoples perspectives.

SCIENCE – Provincial Core Curriculum
Grade 10

Content – Elaborations

- **DNA structure and function:**
  - genes and chromosomes
  - gene expression
  - interactions of genes and the environment
- **patterns of inheritance:** Mendelian genetics, Punnett squares, complete dominance, co-dominance, incomplete dominance, sex-linked inheritance, human genetics
- **mutation:**
  - positive, negative, and neutral impacts
  - mutagens and carcinogens
- **natural selection:**
  - adaptive radiation
  - selection pressure (e.g., adaptation and extinction, invasive species)
  - adaptations
  - extinctions

Content – Elaborations

- **artificial selection:**
  - in agriculture (e.g., monoculture, polyculture, food sustainability)
  - breeding (plant and animal)
- **applied genetics:** genomics, GMOs, gene therapy, cloning, stem cells, reproductive technology, species, population and ecosystems, forensics, genetic engineering
- **ethical considerations:** the health, environmental, social, and political implications of modern genetics
- **chemical reactions:** types include synthesis, decomposition, single-double replacement, combustion/oxidation, neutralization
- **energy change:**
  - exothermic and endothermic
  - activation energy
- **practical applications and implications of chemical processes:** household chemical safety (e.g., ammonia and bleach), combustion (e.g., forest fire, fire triangle, kindling temperature, ignition point, oxygen concentration), polymer chemistry, semiconductors, resource extraction (e.g., ore, fracking), pulp and paper chemistry, food chemistry, corrosion/prevention, tanning, traditional medicines, phytochemistry, pharmaceuticals, environmental remediation, water quality, oil spill cleanup
- **nuclear energy:**
  - fission versus fusion
  - nuclear technologies and implications (e.g., nuclear power, medical isotopes, tanning beds, dental X-rays, food irradiation, radioactive dating)
  - positive and negative impacts, including environmental, health, economic
- **radiation:**
  - ionizing versus non-ionizing
  - alpha, beta, gamma
- **potential:** stored energy (gravitational PE = mgh)
- **kinetic:** energy of motion (translational KE = 1/2 mv^2)
- **transformation of energy:**
  - transfer of energy in closed and open systems
  - heat ($Q = mc\Delta T$)
- **impacts of energy transformations:** pollution, habitat destruction, carbon dioxide output
- **components of the universe over time:** changes to energy, matter, fundamental forces
- **astronomical data and collection methods:** different types of data are collected and analyzed as evidence to support theories about the universe (e.g., radio telescopes, background microwave radiation, red and blue Doppler shift, Mars rover, SNOLAB, ISS, Canadarm/Dextre)