

Course Outline

School Name:	KEEWAYTINOOK INTERNET HIGH SCHOOL
Department Name:	Science
Ministry of Education Course Title:	Biology
Grade Level:	11
Ministry Course Code:	SBI3U

Teacher's Name: Raj Budhram

Developed by: Raj Budhram

Date: October 2015

Revision Date: August 2022

Developed from:

Ontario Ministry of Education. (2008). *The Ontario curriculum, grades 11 and 12, Science*. Toronto ON: Queen's Printer for Ontario.

Text: None

Prerequisite: SNC2D

Credits: One

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval:



Approval Date: September 10, 2022

Course Description/Rationale

This course furthers students' understanding of the processes that occur in biological systems. Students will study theory and conduct investigations in the areas of biodiversity; evolution; genetic processes; the structure and function of animals; and the anatomy, growth, and function of plants. The course focuses on the theoretical aspects of the topics under study, and helps students refine skills related to scientific investigation.

Overall Curriculum Expectations

Scientific Investigation Skills and Career Exploration

- Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating).
- Identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields.

Diversity of Living Things

- Analyse the effects of various human activities on the diversity of living things.
- Investigate, through laboratory and/or field activities or through simulations, the principles of scientific classification, using appropriate sampling and classification techniques.
- Demonstrate an understanding of the diversity of living organisms in terms of the principles of taxonomy and phylogeny.

Evolution

- Analyse the economic and environmental advantages and disadvantages of an artificial selection technology, and evaluate the impact of environmental changes on natural selection and endangered species.
- Investigate evolutionary processes, and analyse scientific evidence that supports the theory of evolution.
- Demonstrate an understanding of the theory of evolution, the evidence that supports it, and some of the mechanisms by which it occurs.

Genetic Processes

- Evaluate the importance of some recent contributions to our knowledge of genetic processes, and analyse social and ethical implications of genetic and genomic research.
- Investigate genetic processes, including those that occur during meiosis, and analyse data to solve basic genetics problems involving monohybrid and dihybrid crosses.
- Demonstrate an understanding of concepts, processes, and technologies related to the transmission of hereditary characteristics

Animals: Structure and Function

- Analyse the relationships between changing societal needs, technological advances, and our understanding of internal systems of humans.
- Investigate, through laboratory inquiry or computer simulation, the functional responses of the respiratory and circulatory systems of animals, and the relationships between their respiratory, circulatory and digestive systems.
- Demonstrate an understanding of animal anatomy and physiology, and describe disorders of the respiratory, circulatory and digestive systems.

Plants: Anatomy, Growth, Function

- Evaluate the importance of sustainable use of plants to Canadian society and other cultures.
- Investigate the structures and functions of plant tissues, and factors affecting plant growth.
- Demonstrate an understanding of the diversity of vascular plants, including their structures, internal transport systems, and their role in maintaining biodiversity.

Course Content

Unit	Length
1. Diversity of Living Things	22 hours
2. Plants: Anatomy, Growth, and Function	25 hours
3. Genetic Processes	22 hours
4. Animals: Structure and Function	19 hours
5. Evolution	22 hours
Total	110 hours

Unit Descriptions

Unit 1 – Diversity of Living Things

In this unit, students focus on taxonomic classification and investigate the anatomic and physiologic bases for those distinctions. The initial activities introduce the use of different criteria for classification, review prior knowledge of characteristics of life, examine the diversity of living organisms, and provide an opportunity to develop research skills. Biological keys will be used to identify specimens. This unit continues to explore biodiversity, introduced in grade 9, and human impact on biodiversity. In a unit project, the students take a field trip to a pond or lake in their communities and they observe organisms around the lake or pond. Also, students take samples of water from the lake or pond for analysis in the classroom.

Unit 2 – Plants: Anatomy, Growth, and Function

In this unit, students examine the role that plants play in Canadian society and other societies. They investigate the strategies that are used in their communities for the conservation and sustainable use of medicinal plants. Plant structure, growth factors, and reproductive mechanisms are investigated. Through microscopic investigation, students examine how the structure of leaves, stems, and roots are adapted to maximize energy capture. Additionally, in this unit, students investigate the impacts of climate change on living things in their communities. Students learn to explain why “Three Sisters” is an example of sustainable agricultural practice, and they investigate how Indigenous people that live in boreal forests have developed sustainable agricultural practice.

Unit 3 – Genetic Processes

In this unit, students develop an understanding of meiosis, Mendel’s model of inheritance, and forms of inheritance that extend beyond Mendel’s model. The students’ ability to identify patterns, predict outcomes and solve problems involving monohybrid, dihybrid, incomplete dominance, co-dominance, and sex-linked traits is emphasized. Students examine some of the recent technological advances in genetics and the contributions of eminent investigators that led to the modern concept of the gene and inheritance. Social and ethical implications of genetic research are explored. At the end of this unit, students examine how forensic DNA evidence is being used in the conviction of murderers and to prove the innocence of the wrongly convicted. This is a complex unit for many Indigenous students so there is a focus on developing techniques to be as resilient as possible. Students have the opportunity to share any personal challenges they had in this unit and the strategies that they used to overcome the difficulties.

Unit 4 – Animals: Structure and Function

This unit focuses on human respiratory, circulatory, and digestive systems: their anatomy, physiology, and disorders. How lifestyle choices impact technological development is also investigated. A unit project allows students to consider lifestyle choices and health impacts. Students learn that they need to include more fibre in their diets although it has no nutrients and how to do so using the resources in their communities. Students collect heart and breathing rate data to observe the effects of smoking which is prevalent in many Indigenous communities. Additionally, students investigate the effects of cigarette smoking on health care and they develop plans to reduce cigarette smoking in their communities. Students investigate the effect of obesity, which is another common issue in First Nation communities, on blood pressure. Finally, students investigate the use of insulin pumps in their communities and learn to explain the risks and benefits of insulin pumps for use by their community members.

Unit 5 –Evolution

In this unit, students focus on evolution as the process of biological change over time based on the relationships between species and their environments. Students analyze the development of the theory of evolution as a scientific explanation based on a large accumulation of evidence. Students also investigate artificial selection: advantages and disadvantages in the environmental and economic spheres. Environmental change in the form of invasive species is examined in order to better understand its effects on natural selection. Finally, students evaluate the possible impact of forest fires in their communities as a result of global warming on natural selection and on the vulnerability of species.

Teaching/Learning Strategies

This course is organized into an eight-week series of lessons and activities that are presented to students in remote northern communities via the internet. The eighth week is used for course consolidation, review, and the final examination. Teacher and students communicate over the internet through timely activity feedback, emails, messages, video and audio calls. Mentors in the classrooms assume the role of liaison between the teacher and student while also supporting a holistic approach to motivate, engage and support each individual student.

A variety of strategies will be used in the online delivery of this course. Some instructional strategies include:

- Academic vocabulary and language
- Cooperative learning
- Adapting to learning styles/multiple intelligences
- Analysis of student work
- Conferencing
- Discovery/Inquiry-based learning
- Generating and testing hypotheses
- Graphic organizers
- Hands -on learning
- Homework and practice
- Identifying similarities and differences
- Modelling
- Sketching to learn
- Mentoring
- Visualization

Learning goals are discussed at the beginning of each assignment and success criteria is provided to students. The success criteria are used to develop the assessment tools in this course, including rubrics and checklists.

Evaluation

The final grade will be determined as follows (Ontario Ministry of Education, 2010):

- Seventy percent of the grade will be based on evaluation conducted throughout the course. This portion of the grade should reflect the student's most consistent level of achievement throughout the course, although special consideration should be given to more recent evidence of achievement.
- Thirty percent of the grade will be based on a final evaluation administered at or towards the end of the course. This evaluation will be based on evidence from one or a combination of the following: an examination, a performance, an essay, and/or another method of evaluation suitable to the course content. The final evaluation allows the student an opportunity to demonstrate a comprehensive achievement of the overall expectations for the course (p. 41).

Ontario Ministry of Education. (2010). *Growing Success: Assessment, evaluation, and reporting in Ontario schools*. Toronto ON: Queen's Printer for Ontario

Type of assessment	Category	Details	Weighting (%)
Term Work (70%)	Knowledge/ Understanding	<p>Identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields;</p> <p>Demonstrate an understanding of the diversity of living organisms in terms of the principles of taxonomy and phylogeny;</p> <p>Demonstrate an understanding of the theory of evolution, the evidence that supports it, and some of the mechanisms by which it occurs;</p> <p>Demonstrate an understanding of concepts, processes, and technologies related to the transmission of hereditary characteristics;</p> <p>Demonstrate an understanding of animal anatomy and physiology, and describe disorders of the respiratory, circulatory, and digestive systems;</p> <p>Demonstrate an understanding of the diversity of vascular plants, including their structures, internal transport systems, and their role in maintaining biodiversity.</p>	12
	Thinking	<p>Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analyzing and interpreting, and communicating);</p> <p>Investigate, through laboratory and/or field activities or through simulations, the principles of scientific classification, using appropriate sampling and classification techniques;</p> <p>Investigate evolutionary processes, and analyse scientific evidence that supports the theory of evolution;</p> <p>Investigate genetic processes, including those that occur during meiosis, and analyse data to solve basic genetics problems involving monohybrid and dihybrid crosses;</p> <p>Investigate, through laboratory inquiry or computer simulation, the functional responses of the respiratory and circulatory systems of animals, and the relationships between their respiratory, circulatory, and digestive systems;</p> <p>Investigate the structures and functions of plant tissues, and factors affecting plant growth.</p>	18
	Communication	<p>Expression and organization of ideas and information;</p> <p>Communication for different audiences and purposes in oral, visual, and/or written forms;</p> <p>Use of conventions, vocabulary, and terminology of the discipline in oral, visual, and/or written forms.</p>	17
		<p>Analyse the effects of various human activities on the diversity of living things;</p> <p>Analyse the economic and environmental advantages and disadvantages of an artificial selection technology, and evaluate the impact of environmental changes on natural selection and endangered species;</p>	

	Application	Evaluate the importance of some recent contributions to our knowledge of genetic processes, and analyse social and ethical implications of genetic and genomic research; Analyse the relationships between changing societal needs, technological advances, and our understanding of internal systems of humans; Evaluate the importance of sustainable use of plants to Canadian society and other cultures.	23
Final Evaluation (30%)	Culminating Activity (15%)	Knowledge/Understanding	2.5
		Thinking	4
		Communication	4
		Application	4.5
	Final Exam (15%)	Knowledge/Understanding	2.5
		Thinking	4
		Communication	4
		Application	4.5
TOTAL			100

Assessment/Evaluation Strategies

A variety of assessment and evaluation methods, strategies and tools are required as appropriate to the expectation being assessed. These include diagnostic, formative and summative within the course and within each unit.

Assessment *for* learning and assessment *as* learning are obtained through a variety of means, including the following:

- Ongoing descriptive feedback
- Conversations with students regularly to verbalize observations, ask questions, and clarify understanding
- Self-assessment (e.g., weekly self-assessment of learning, relative to specific course content as well as in contextual school, community and Land based learning);
- Peer assessment (e.g., peer feedback on personal goals related to course specific content and generalised throughout the school day);
- Mentor observations (e.g. of specific course expectations during Land based and cultural activities as well as during course specific activities);

Evidence of student achievement (assessment *of* learning) is collected from various sources, including the following:

- Ongoing assessment/observations of most consistent work, with consideration given to most recent work
- Quiz
- celebration);
Conversations with students (e.g., discussion about the medicinal plants that are used in the community and their health benefits);

- Summative unit activities (e.g., students will investigate the impacts of climate change in their communities and discuss what needs to be done at the community level, the national level, and the international level to reduce the effects of climate change.);
- Culminating activity;
- Exam.

The Ministry of Education's 2010 document, *Growing Success*, outlines the seven fundamental principles that guide best practice in the assessment and evaluation of students. KiHS teachers use practices that:

- are fair, transparent, and equitable for all students;
- support all students, including those with special education needs, those who are learning the language of instruction (English or French), and those who are First Nation, Métis, or Inuit;
- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students;
- are communicated clearly to students and parents at the beginning of the course and at other points throughout the school year or course;
- are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning;
- provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement;
- develop students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan next steps for their learning (p.6).

Resources

All the Science. (2022, July 13). *What is Genetic Diversity*.

<https://www.allthescience.org/what-is-genetic-diversity.htm>

Amoeba Sisters. (2015, January 23). *Punnett squares and sex-linked traits*.

<https://www.youtube.com/watch?v=h2xufrHWG3E>

Amoeba Sisters. (2017, Apr 9). *Speciation*.

<https://www.youtube.com/watch?v=udZUaNKXbJA>

arifwaqas22. (2011, November 29). *Edge-ucation: Science: Respiration in human body*.

<https://www.youtube.com/watch?v=fmd5ZhVt2VY>

Bozeman Science. (2011, June 24). *Speciation*. <https://www.youtube.com/watch?v=rlfNvoyijmo>

Bozeman Science. (2012, April 2). *Viruses*. https://www.youtube.com/watch?v=L8oHs7G_syl

Bozeman Science. (2012, April 21). *Plant control*.

<https://www.youtube.com/watch?v=HdwlclkSoBY>

Brightstorm. (2010, September 1). *Codominance: Incomplete dominance*.

https://www.youtube.com/watch?time_continue=3&v=2LhwbM7FupQ

- Britannica. (n.d.). *Sexual Selection*.
<https://www.britannica.com/science/group-selection>
- CBC. (2014, Feb 25). *Organ transplant in Canada see 'moderate increase'*.
<https://www.cbc.ca/news/health/organ-transplants-in-canada-see-moderate-increase-1.2550727>
- CHSBiomonsters. (2013, January 20). *Monoybrid crosses*.
<https://www.youtube.com/watch?v=rQ3oe39j7m8>
- Clore, J. (2010, April 13). *Dihybrid crosses*. <https://www.youtube.com/watch?v=cvTt-azvHsA>
- Cold Spring Harbour Laboratory. (n.d.). *Biology animations*. Retrieved on September 30, 2020,
<https://dnlc.cshl.edu/resources/animations/>
- Consumer Affairs. (2020, Feb 28). *Best Home Gym and Exercise Equipment*.
<https://www.consumeraffairs.com/health/fitness-equipment/>
- Drollinger, M. (2012, November 21). *What is selective breeding?*
https://www.youtube.com/watch?v=W_CnR0Ak604
- Gizmos. (n.d.). *Online simulations that power inquiry and understanding*.
<https://www.explorelarning.com/>
- Global Issues. (2014, January 9). *Climate changes affect biodiversity*.
<https://www.globalissues.org/article/172/climate-change-affects-biodiversity>
- Government of Canada. (2012, October 2). *Insulin pumps*. <https://www.canada.ca/en/health-canada/services/healthy-living/your-health/medical-information/insulin-pumps.html>
- Heilbrunn, M. (2012, April 25). *Artificial selection*.
<https://www.youtube.com/watch?v=K3pPgQcCtCU>
- Iken Idu. (2013, January 23). *Vegetative reproduction: Artificial propagation*.
<https://www.youtube.com/watch?v=TdiibRXXJ6g>
- Kite, V. (2013, January 10). *Plants colonize land*.
<https://www.youtube.com/watch?v=yGW9s7ki3zl>
- Mayo Clinic. (2018, July 24). *CRISPR Explained*.
<https://www.youtube.com/watch?v=UKbrwPL3wXE>
- Microbus. (2022). *Pond water critters you can see with a microscope*. <https://microscope-microscope.org/pond-water-critters-protozoan-guide/>
- Neural Academy. (2018, Oct 11). *Endosymbiosis*
<https://www.youtube.com/watch?v=8oSqXAwLsZc>
- Ojibwe People's Dictionary. (n.d.). <https://ojibwe.lib.umn.edu/>

- Ontario Ministry of Education. (2008). *The Ontario curriculum grades 11 and 12: Science*. Toronto, ON: Queen's Printer for Ontario.
- Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation, and reporting in Ontario schools*. Toronto, ON: Queen's Printer for Ontario.
- Ontario Ministry of Education. (2014). *Achieving excellence: A renewed vision for education in Ontario*. Toronto ON: Queen's Printer for Ontario.
- Ontario Ministry of Education. (2017). *Indigenous education strategy*.
<http://www.edu.gov.on.ca/eng/aboriginal/>
- Parrott, D. (2016, Apr 5). *Phylogenetics and Reading Phylogenetic Trees*.
<https://www.youtube.com/watch?v=D9HIZREK528>
- Plantation. (2020, September 20). In *Wikipedia*. <https://en.wikipedia.org/wiki/Plantation>
- Renee, C. (2015, March 14). *LS1 genetic drift animation*.
<https://www.youtube.com/watch?v=VTC3SpXWd-E>
- RihochetScience. (2015, January 18). *Prokaryotic vs. eukaryotic cells*.
<https://www.youtube.com/watch?v=RQ-SMCmWB1s>
- RWS Web Portal. (2016, July 25). *Life in a Drop of Water*.
<https://www.youtube.com/watch?v=jpc-cggWojk>
- Science Filmmaking Tips. (2012, September 12). *Monocots vs. dicots explained*.
<https://www.youtube.com/watch?v=gl2RxzAT-ww>
- Scholarswing. (2017 Dec 6). *Tissue Culture*.
<https://www.youtube.com/watch?v=xuwV3yWCxW8&t=1s>
- Six Science. (2014, Sept 21). *Biology Natural selection*.
<https://www.youtube.com/watch?v=lradhfO9x2g>
- Stanford University. (n.d.). *Kidney transplantation: Past, present and future*.
https://web.stanford.edu/dept/HPS/transplant/html/frequently_asked_questions.html
- StrawBale TV. (2007, Jun 15). *Benefits of straw bale construction*.
<https://www.youtube.com/watch?v=A3ZWr9sdUGY>
- Sumanas, Inc. (2007). *Measuring blood pressure*.
<http://www.sumanasinc.com/webcontent/animations/content/bloodpressure.html>
- The Jerusalem Post. (2011, July 17). *The latest in fitness equipment*.
<https://labtestsonline.org/conditions/pregnancy-preconception>
- The Stupendous Six Kingdoms. (n.d.). *Dichotomous key*.
<https://sites.google.com/site/4elenacourtneytori/dichotomous-key>
- The Balancecareer. (2022, June 16). *Jobs for Graduates with a Biology Degree*.

<https://www.thebalancecareers.com/top-jobs-for-biology-majors-2059884>

ThoughtCo. (2019, May 9). *History of the artificial heart*. <https://www.thoughtco.com/history-of-the-artificial-heart-1991661>

TutorVista. (2010, April 29). *Respiratory organs in amphibians*. <https://www.youtube.com/watch?v=Nfojq4ikHH0>

Wilhelm, D. (2013, Oct 21). *Frog Dissection*. <https://www.youtube.com/watch?v=NKQzoxUWrlo>

Program Planning

This course is offered to Indigenous students living in isolated, northern Ontario communities. It is offered by qualified teachers in a blended classroom with a balance of academic, wellness, land-based learning, local language and culture to support the success of the whole student. This course uses the internet for instruction, demonstration and research. It utilizes a student-centered semi-virtual classroom which capitalizes on the strengths of internet program delivery to minimize the disadvantages of geographic remoteness.

Students are presented with 1320 minutes of instruction/activity via the internet over the period of one week. All lessons, assignments, questions and course material is presented in this manner, with approved print materials available as a student resource in each classroom. The student and instructor communicate via the internet, while a classroom mentor (a fully qualified teacher) assists students in completing tasks in a timely manner and provides support as required.

Indigenous and local content is used throughout the course to meet students' learning needs. Opportunities for outdoor activities and land-based learning are also incorporated and students are encouraged to use local knowledge in their products. Considerations are made to the learning preferences of the student population and lessons can be adjusted for individual students as required. Teachers consult the Ontario Ministry of Education policies, guidelines and important initiatives when planning a comprehensive program in this area.