

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: September 2017

Developed from: The Ontario Curriculum, Grade 11 and 12: Science 2008 (Revised)

Text: None

Prerequisite: SNC2D

Credits: One

Length: 110 hours

Principal's Name: Kevin Dempsey

Principal's Approval (signature)



Approval Date: September 11, 2017

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 | 22.75 hours |
| 2. Plants: Anatomy, Growth and Function | 26.00 hours |
| 3. Genetic Processes | 22.75 hours |
| 4. Animals: Structure and Function | 19.50 hours |
| 5. Evolution | 22.75 hours |
| Total | 113.75 hours |

Unit Descriptions

Unit 1 – Diversity of Living Things

In this unit students focus on taxonomic classification and being to 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 will continue to explore biodiversity, introduced in grade 9, and human impact on biodiversity. A unit project will examine the shrub and tree diversity in their community.

Unit 2 – Plants: Anatomy, Growth and Function

In this unit, students examine the role that plants play in Canadian and other societies. 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. A unit project will have students experimenting with the germination and growth of seedlings under various conditions.

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 also 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. Finally, at the end of this unit, we will examine how forensic DNA evidence is being used in the conviction of murderers and to prove the innocence of the wrongly convicted.

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 will also be investigated. A unit project will consider lifestyle choices and their health impacts. Students will collect heart and breathing rate data to observe the effects of smoking.

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 will analyze the development of the theory of evolution as a scientific explanation based on a large accumulation of evidence. Students will also investigate artificial selection: advantages and disadvantages in the environmental and economic spheres. Finally, environmental change in the form of invasive species will be examined to understand its effects on natural selection.

Teaching/Learning Strategies

This course is organized into an eight-week series of lessons and activities that will be presented to students in remote northern communities via the internet. The eighth week will be used for course consolidation, review and the final examination. Teacher and students will communicate over the internet, while mentors in the classrooms will assume the role of liaison between the teacher and 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 will be discussed at the beginning of each assignment and success criteria will be 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 per cent 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 per cent 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 comprehensive achievement of the overall expectations for the course (p. 47).

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 | <ul style="list-style-type: none"> - identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields; - demonstrate an understanding of the diversity of living organisms in terms of the principles of taxonomy and phylogeny; - demonstrate an understanding of the theory of evolution, the evidence that supports it, and some of the mechanisms by which it occurs; - demonstrate an understanding of concepts, processes, and technologies related to the transmission of hereditary characteristics; - demonstrate an understanding of animal anatomy and physiology, and describe disorders of the respiratory, circulatory, and digestive systems; - demonstrate an understanding of the diversity of vascular plants, including their structures, internal transport systems, and their role in maintaining biodiversity. | 12 |
| | Thinking | <ul style="list-style-type: none"> - 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); - investigate, through laboratory and/or field activities or through simulations, the principles of scientific classification, using appropriate sampling and classification techniques; - investigate evolutionary processes, and analyse scientific evidence that supports the theory of evolution; - investigate genetic processes, including those that occur during meiosis, and analyse data to solve basic genetics problems involving monohybrid and dihybrid crosses; - 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; - investigate the structures and functions of plant tissues, and factors affecting plant growth. | 18 |
| | Communication | <ul style="list-style-type: none"> - expression and organization of ideas and information; - communication for different audiences and purposes in oral, visual, and/or written forms; - use of conventions, vocabulary, and terminology of the discipline in oral, visual, and/or written forms. | 17 |

| | | | |
|------------------------|----------------------------|---|-----|
| | Application | <ul style="list-style-type: none"> - analyse the effects of various human activities on the diversity of living things; - 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; - 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 |
| | Final Examination (15%) | Communication | 4 |
| | | Application | 4.5 |
| | | 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
- Small-group conversations to develop their opinions and communication skills
- Mentor observations of student's performance while conducting experiments and scientific research
- Conversations with student on a regular basis to verbalize observations, ask questions, and clarify understanding
- Self-assessment (e.g., weekly self-assessment of learning)

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
- Culminating Activity
- Final Exam

Resources

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

Ontario Ministry of Education. (2017). *Indigenous education strategy*. Retrieved from <http://www.edu.gov.on.ca/eng/aboriginal/>

A Selection of Science and Education Internet Sites

<http://www.explorellearning.com/>

<https://sites.google.com/site/4elenacourtneytori/dichotomous-key>

<http://www.microscope-microscope.org/applications/pond-critters/pond-critters.htm>

<https://en.wikipedia.org/wiki/Plantation>

<http://www.globalissues.org/article/172/climate-change-affects-biodiversity>

<http://stemcells.nih.gov/info/basics/pages/basics1.aspx>

<http://www.wisegeek.com/what-is-genetic-diversity.htm>

<https://labtestsonline.org/understanding/wellness/pregnancy/pre-conception/cf/>

<http://www.jpost.com/Health-and-Science/The-latest-in-fitness-equipment>

<http://www.modvive.com/2013/09/20/technology-changed-fitness/>

http://web.stanford.edu/dept/HPS/transplant/html/frequently_asked_questions.html

<http://inventors.about.com/od/famousinventions/fl/The-History-of-the-Artificial-Heart.htm>

<http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/med/pumps-insulin-pompes-eng.php>

<http://biology.csusb.edu/careers/>

You Tube Videos

<https://www.youtube.com/watch?v=RQ-SMCmWB1s>

<https://www.youtube.com/watch?v=yGW9s7ki3zl>
https://www.youtube.com/watch?v=L8oHs7G_syl
<https://www.youtube.com/watch?v=3ESXvLHceDc>
https://www.youtube.com/watch?v=_cpBK2t0Yeo
<https://www.youtube.com/watch?v=gl2RxzAT-ww>
<https://www.youtube.com/watch?v=HdwlclKSoBY>
https://www.youtube.com/watch?v=3lj1eW_gsrM
<https://www.youtube.com/watch?v=TdiibRXXJ6g>
<https://www.youtube.com/watch?v=A3ZWr9sdUGY>
http://highered.mheducation.com/sites/0072495855/student_view0/chapter28/animation_how_meiosis_works.html
<https://www.youtube.com/watch?v=rQ3oe39j7m8>
<https://www.youtube.com/watch?v=cvTt-azvHsA>
https://www.youtube.com/watch?time_continue=3&v=2LhwbM7FupQ
<https://www.youtube.com/watch?v=h2xufrHWG3E>
<https://www.youtube.com/watch?v=fmd5ZhVt2VY>
<https://www.youtube.com/watch?v=Nfojq4ikHH0>
<http://www.sumanasinc.com/webcontent/animations/content/bloodpressure.html>
http://mhhe.com/biosci/genbio/virtual_labs/BL_16/BL_16.html
<https://www.youtube.com/watch?v=IradhfO9x2g>
<https://www.youtube.com/watch?v=K3pPgQcCtCU>
<https://www.youtube.com/watch?v=VTC3SpXWd-E>
<https://www.youtube.com/watch?v=rIfNvoyijmo>
https://www.youtube.com/watch?v=W_CnR0Ak604

Program Planning

This course is offered to students living in isolated northern Ontario communities which do not have access to regular high school facilities, equipment or teachers associated with secondary education. 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 tutoring as required. Students may also receive support from various programs at KIHS, including the First Nation Student Success Program and the Special Education Program.

Indigenous and local content is used throughout the course to meet students' learning needs. Considerations are made to the learning preferences of the student population and lessons can be adjusted for individual students as required.