Course Outline

School Name: KEEWAYTINOOK INTERNET HIGH SCHOOL

Department Name: SCIENCE

Ministry of Education Course Title: ***Biology***

Grade Level: ***11, University Preparation***

Ministry Course Code: *SBI3U*

Teacher's Name: Raj Budhram

Developed by: K. A. Eliyahu Pivnick Date: December 2009

Revision Date: September 2015

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

Text: none

Prerequisite: Grade 10 Science, Academic

Credits: One (1.0)

Length: 110 hours

Principal's Name: Kevin Dempsey

Principal's Approval (signature) 

Approval Date: September 8, 2015

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. Investigation Skills and Career Studies	10 hours
2. Diversity of Living Things	20 hours
3. Evolution	20 hours
4. Genetic Processes	20 hours
5. Animals: Structure and Function	20 hours
6. Plants: Anatomy, Growth and Function	20 hours
Total	110 hours

Unit Descriptions

Unit 1- Scientific Investigation Skills

This unit extends the student's investigation skills from previous years. More emphasis is placed on analysis synthesis and accepted forms of academic documentation than previous years. Greater emphasis is placed on accuracy, safe handling of laboratory materials, bias, and sources of experimental error. Lab reports will become more formalized. The material for this unit will be covered throughout the other units.

Unit 2 – 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 3 – 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.

Unit 4- 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 5- 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 6- 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.

Teaching/Learning Strategies

General Strategies

a. Cooperative learning: a range of team based learning approaches where students work together to complete a task.

b. Graphic organizers: visual displays to organize information into things like trees, flowcharts, webs, etc. They help students to consolidate information into meaningful whole and they are used to improve comprehension of stories, organization of writing, and understanding of difficult concepts in word problems.

c. Hands-on, active participation: Designing activities so that students are actively involved in the project or experiment. Hands-on participation is as important as verbal participation in the activity.

d. K-W-L: know, want to know, learned, routine. A form of self-monitoring where students are taught to list what they know already about a subject, what they want to know, and later what they learned.

e. Modeling/teacher demonstration: Teacher demonstrates how to do a lab or experiment before having the students try it on their own.

f. Multimedia: Use of digital media including text, links to vetted web sites, video, word processing, dynamic visualization programs (i.e., Geometer's Sketchpad, Virtual Dissection, Virtual Lab).

g. Peer tutoring: Having students working pairs with one student tutoring the other student on a particular concept. (Develops communication as well as knowledge.)

h. Response journal: Students record in a journal what they learned that day or strategies they learned or questions they have. Students can share their ideas in the class, with partners, and with the teacher.

i. Tactile, concrete experiences in math and science: Using three dimensional objects in math/science instruction such as geometrical shapes, coins, models, machines, chemicals or blocks.

Lesson Delivery

The teaching of the lessons incorporates the following list of delivery approaches:

- Direct Instruction (local classroom mentor)
- Interactive lessons (Videoconference)
- On-line instruction (self-paced lessons)
- Demonstration (both laboratory work in the classroom as well as animated on-line demonstrations)
- Case study
- Laboratory/Simulated Dissections and microscope work
- Field trips for data collection
- Internet research
- Group work
- Independent Study Units (ISU's)
- Interviews of local individuals
- Direct Instruction (on-line)

Evaluation

The final grade will be determined as follows:

- 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. The final evaluation allows the student an opportunity to demonstrate comprehensive achievement of the overall expectations for the course. *Growing Success: Assessment, Evaluation and Reporting in Ontario Schools*. Ontario Ministry of Education Publication, 2010 p. 41

Type of Assessment	Category	Details		Weighting (%)
Term Work (70%)	Knowledge/ Understanding	Information obtained from lessons, websites linked to from lessons, textbook readings. Knowledge & understanding demonstrated through work submitted and through the ability to answer questions requiring targeted knowledge of concepts		12
	Inquiry	Independent projects, experiments, answering questions requiring application of concepts to novel situations		18
	Communication	Report writing, Science journal, Short essay questions		17
	Making Connections	Knowledge is applied and connected to everyday life through investigating careers, observing the night sky, examining home electricity use and practices, and examining the properties of everyday materials.		23
Final Evaluation (30%)	Culminating Activity 15 %	Written examination designed to cover all of the overall expectations of the course	K/U	2.5
			T/ I	4.0
			C	4.0
			A	4.5
	Final Exam 15 %	Written examination designed to cover all of the overall expectations of the course	K/U	2.5
			T / I	4.0
			C	4.0
			A	4.5
Total				100

Assessment/Evaluation Strategies

Diagnostic (assessment for learning)

- Pre-unit subject assessment, discussion, KWL, mind-maps, prior student records, surveys

Formative (assessment for learning)

- Anecdotal records, check lists (performance observed, self-assessment), rubrics (what to demonstrate and how they will be assessed).

- Students are given specific, descriptive, and timely feedback: they can assess their own learning and become active participants. (Assessment *as* learning.)
- Online submissions, Rubrics (general and task specific), Projects, Drawing or Map-making (photographed for submission) , Rating scales, Quizzes, Surveys, Worksheets, Reports, Journals, Performance Tasks, Achievement chart, Field Observations

Summative (assessment of learning)

- Quizzes, tests, labs, Independent Study Units (ISU's), group work.
- Assignments: written submissions; audio, visual or kinesthetic presentations (including poems, dance, videos, and posters), software program results (ie, virtual chemistry and electricity submissions) and models.
- Performance (ie, safe use of scientific equipment, proper use of equipment to collect, organize and analyze data).

Resources

A. General References

Growing Success: Assessment, Evaluation and Reporting in Ontario Schools, 1st Ed, Ministry of Education of Ontario, 2010

B. A Selection of Science and Education Internet Sites

Ministry's web site. http://www.edu.gov.on.ca/eng/webmap.html
Education Network of Ontario http://www.enoreo.on.ca
Education resources on the web http://www.educ.uvic.ca/depts/snsc/pages/weblinks/weblinks.htm

Animated interactive science
http://www.explorelearning.com/
http://ippex.pppl.gov/interactive/matter/intro.html
http://frog.edschool.virginia.edu//Frog1/

Other important sites
http://www.howstuffworks.com/http://www.grc.nasa.gov/WWW/K-12/teacher.htm
http://www.uq.edu.au/_School_Science_Lessons/
http://www.webelements.com/
http://www.globalwarming101.com/

Program Planning

In science, an understanding of "terminology and concepts" is a precursor to developing skills of investigation and communication. In addition, relating science to society and the environment requires a clear understanding of all three topics. Students must therefore have a firm foundation in scientific terminology and concepts to successfully complete the curriculum. Emphasis in

programming will focus on building a strong foundation for future success rather than trying to move routinely through the curriculum. Each student will struggle and excel at various points, and sometimes the class as a whole will need extra time to gain proficiency in a topic. Progress need not be linear to be successful.
As much effort as possible will be made to integrate community concerns and interest in the curriculum. Open discussion is encouraged – in fact, it can be used to assess communication skills.

This course is offered to students living in isolated communities who do not have access to normal high school facilities, equipment or teachers associated with secondary education. The course uses Internet connectivity for most instruction and feedback. It utilizes a student centered semi-virtual classroom which capitalizes on the strengths of internet program delivery to minimize the disadvantages of geographic remoteness.

This course is organized in a eight-week series of lessons delivered to students via Internet. Desktop computers are set up at an access site in their communities. The 8th week is used for topic consolidation, review, and the final examination. The delivery of lessons, assignments, questions, and course material uses an Internet connection. The student attends school in full days similar to traditional face-to face programming. The classroom is similar to a computer classroom with a student to computer ratio of 1:1.

Most communication between students and the teacher is performed through the Internet. At each remote location, a OCT qualified teacher/mentor assumes the role of liaison between the instructor and the student. There are also weekly on-line interactive sessions between teacher and students, and additional on-line tutorials as needed.