

Course Outline

School Name: KEEWAYTINOOK INTERNET HIGH SCHOOL

Department Name: Science

Ministry of Education Course Title: Biology

Grade Level: 12

Ministry Course Code: SBI4U

Teacher's Name: Raj Budhram

Developed by: Raj Budhram Date: August 2016

Revision Date: August 2019

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

Text: None

Prerequisite: SBI3U

Credits: One

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval:



Approval Date: September 5, 2019

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 biochemistry, cell metabolic processes, molecular genetics, homeostasis within the body, and population dynamics. The course focuses on the theoretical aspects of the topics under study, and helps students refine skills related to scientific investigation.

Overall Curriculum Expectations

A. 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, analyzing and interpreting, and communicating);
- identify and describe a variety of careers related to the fields of science under study, and identify scientists, including Canadians, who have made contributions to those fields.

B. BIOCHEMISTRY

- analyse technological applications of enzymes in some industrial processes, and evaluate technological advances in the field of cellular biology;
- investigate the chemical structures, functions, and chemical properties of biological molecules involved in some common cellular processes and biochemical reactions;
- demonstrate an understanding of the structures and functions of biological molecules, and the biochemical reactions required to maintain normal cellular function.

C. METABOLIC PROCESSES

- analyse the role of metabolic processes in the functioning of biotic and abiotic systems, and evaluate the importance of an understanding of these processes and related technologies to personal choices made in everyday life;
- investigate the products of metabolic processes such as cellular respiration and photosynthesis;
- demonstrate an understanding of the chemical changes and energy conversions that occur in metabolic processes.

D. MOLECULAR GENETICS

- analyse some of the social, ethical, and legal issues associated with genetic research and biotechnology;
- investigate, through laboratory activities, the structures of cell components and their roles in processes that occur within the cell;
- demonstrate an understanding of concepts related to molecular genetics, and how genetic

modification is applied in industry and agriculture.

E. HOMEOSTASIS

- evaluate the impact on the human body of selected chemical substances and of environmental factors related to human activity;
- investigate the feedback mechanisms that maintain homeostasis in living organisms;
- demonstrate an understanding of the anatomy and physiology of human body systems, and explain the mechanisms that enable the body to maintain homeostasis.

F. POPULATION DYNAMICS

- analyse the relationships between population growth, personal consumption, technological development, and our ecological footprint, and assess the effectiveness of some Canadian initiatives intended to assist expanding populations;
- investigate the characteristics of population growth, and use models to calculate the growth of populations within an ecosystem;
- demonstrate an understanding of concepts related to population growth, and explain the factors that affect the growth of various populations of species.

Course Content

Unit	Length
1. Biochemistry	19 hours
2. Cellular Metabolic Processes	22 hours
3. Molecular Genetics	25 hours
4. Homeostasis in the Body	22 hours
5. Population Dynamics	22 hours
Total	110 hours

Unit Descriptions

Unit 1: Biochemistry

In this unit, students explore the structure and function of biologically essential macromolecules, and the reactions that form and break them down. They explore how the properties of these groups of compounds make possible organelles, the cell membrane, enzymes, and their respective properties. They examine the ways in which enzymes are used in the production of foods and pharmaceuticals.

Unit 2: Cellular Metabolic Processes

In this unit, students explore the biochemical pathways organisms use in photosynthesis and to create metabolically useful energy during cellular respiration. Students examine energy transformations in living cells through laboratory investigations and computer simulations. The unit culminates with the drawing of flow charts to detail the design of their effective “metabolic factory.”

Unit 3: Molecular Genetics

In this unit, students examine the structure and function of DNA and RNA, and their role in protein synthesis and control of gene expression. Students investigate the advances in knowledge about genetics during the 20th and 21st centuries, and explore a variety of genetic technologies. The unit culminates with individual research on ethical considerations in one of many current areas of controversy in biotechnology.

Unit 4: Homeostasis

Through analysis of a variety of changing conditions, students examine the complexity of homeostatic mechanisms, including nervous and hormonal control of metabolic activity, the maintenance of water, ionic, thermal and acid-base equilibria, and reproduction. The concept of feedback mechanisms is key throughout. This unit links to the animal anatomy and physiology unit in SBI3U. Students consider the use of drugs in a variety of contexts and their intended and unintended effects on the body. We conclude with the impact of environmental factors on the maintenance of homeostasis, and examine related societal issues.

Unit 5: Population Dynamics

Designed as an overview of population dynamics, this unit focuses on the effects of relationships within ecosystems and other factors that regulate and limit population growth. The carrying capacity of Earth will also be studied in terms of human population trends. The End-of-Unit Task is an individual assessment of the contribution of population growth and changing consumption patterns to current environmental issues combined with a re-evaluation of personal consumptive habits.

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.

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. 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 structures and functions of biological molecules, and the biochemical reactions required to maintain normal cellular function; - demonstrate an understanding of the chemical changes and energy conversions that occur in metabolic processes; - demonstrate an understanding of concepts related to molecular genetics, and how genetic modification is applied in industry and agriculture. - demonstrate an understanding of the anatomy and physiology of human body systems, and explain the mechanisms that enable the body to maintain homeostasis; -demonstrate an understanding of concepts related to population growth, and explain the factors that affect the growth of various populations of species. 	12

	Thinking	-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 the chemical structures, functions, and chemical properties of biological molecules involved in some common cellular processes and biochemical reactions; - investigate the products of metabolic processes such as cellular respiration and photosynthesis; - investigate, through laboratory activities, the structures of cell components and their roles in processes that occur within the cell; - investigate the feedback mechanisms that maintain homeostasis in living organisms; - investigate the characteristics of population growth, and use models to calculate the growth of populations within an ecosystem.	17.5
	Communication	-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.	17.5
	Application	-analyse technological applications of enzymes in some industrial processes, and evaluate technological advances in the field of cellular biology; -analyse the role of metabolic processes in the functioning of biotic and abiotic systems, and evaluate the importance of an understanding of these processes and related technologies to personal choices made in everyday life; - analyse some of the social, ethical, and legal issues associated with genetic research and biotechnology; - evaluate the impact on the human body of selected chemical substances and of environmental factors related to human activity; -analyse the relationships between population growth, personal consumption, technological development, and our ecological footprint, and assess the effectiveness of some Canadian initiatives intended to assist expanding populations.	23
Final Evaluation (30%)	Culminating Activity (15%)	Knowledge/Understanding	2.5
		Thinking	4
		Communication	4
	Final Examination (15%)	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 students regularly 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
- 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/>

Websites:

<https://ojibwe.lib.umn.edu/>

https://www.google.ca/search?q=beaver+representing+wisdom&source=lnms&tbn=isch&sa=X&ved=0ahUKEwif69PR0J3dAhUKzoMKHd1OCWEQ_AUICigB&biw=1347&bih=604#imgrc=sFQMgqDtQfVczM:

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

http://www.ehow.com/info_8354367_pros-energy-use-medical-science.html

<https://microbewiki.kenyon.edu/index.php/Bioremediation>
<https://en.wikipedia.org/wiki/Bioaugmentation>
https://en.wikipedia.org/wiki/Anti-obesity_medication
<http://www.drugs.com/article/prescription-weight-loss-drugs.html>
<http://www.drugs.com/article/prescription-weight-loss-drugs.html>
<http://www.actionbioscience.org/genomics/crg.html>
<http://regulatingbiotechnology.weebly.com/>
https://en.wikipedia.org/wiki/Bovine_somatotropin
<http://www.actionbioscience.org/biotechnology/margawati.html>
<http://www.scq.ubc.ca/transgene-escape-are-traditional-corn-varieties-in-mexico-threatened-by-transgenic-corn-crops/>
<https://en.wikipedia.org/wiki/Cloning>
<http://www.greenfacts.org/en/endocrine-disruptors/endocrine-disruptors.htm>

YouTube Videos

<https://www.youtube.com/watch?v=MA-ouz1LtpM>
https://www.youtube.com/watch?v=_DZtsp3-7IU
https://www.youtube.com/watch?v=jods4dgY_JI
<https://www.youtube.com/watch?v=qpw2p1x9Cic>
https://www.youtube.com/watch?v=34ESzqzf_Uo
<https://www.youtube.com/watch?v=znhalRdr5Zs>
<https://www.youtube.com/watch?v=v590JJV96lc>
<https://www.youtube.com/watch?v=uv4pV3PIf4s>
<https://www.youtube.com/watch?v=KpgZG9T0y34>
https://www.youtube.com/watch?v=0s_xZqvwm_s
<https://www.youtube.com/watch?v=TNKWgcFPHqw>
<https://www.youtube.com/watch?v=WsY1t6ovYL8>
<https://www.youtube.com/watch?v=WsofH466lqk>
<https://www.dnalc.org/resources/3d/>
<https://www.youtube.com/watch?v=5bLEDd-PSTQ>

<https://www.youtube.com/watch?v=3S3ZOmleAj0>
<https://www.youtube.com/watch?v=5h-4mU8pyFc>
<https://www.youtube.com/watch?v=IPdQwdGgyfQ>
<https://www.youtube.com/watch?v=AVNadhs28lk>
<https://www.youtube.com/watch?v=bEFLBf5WEtc>
https://www.youtube.com/watch?v=eEcy9k_KsDI
<https://www.youtube.com/watch?v=DbR9xMXuK7c>
https://www.youtube.com/watch?v=W_CnR0Ak604
<https://www.youtube.com/watch?v=zLXpft9GYx4>
<https://www.youtube.com/watch?v=Hlg7oh2OcOc>
https://www.youtube.com/watch?v=b_svYGmlpxs
<https://www.youtube.com/watch?v=xZ773hCN2sU>

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 promptly 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.