



TFS High School
 5635 Yong St. Suite 206,
 Toronto, Ontario M2M 3S9

COURSE OUTLINE

Biology 12 (University)
SBI4U

Department	Science
Instructor	Mr. Abbas Hemmati
Course Development Date	September 2012
Ministry Course Code	SBI4U
Credit Value	1.00
Ministry Curriculum Document	Policy Document: <i>Science, the Ontario Curriculum, Grades 11 and 12, 2008 (Revised)</i> http://www.edu.gov.on.ca/eng/curriculum/secondary/2009science11_12.txt http://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf
Prerequisites	SBI3U Grade 11 Biology, University
Course Revision Date (TFS)	September 2020

Course Description

This course provides students with the opportunity for in-depth study of the concepts and processes associated with biological systems. Students will study theory and conduct investigations in the areas of biochemistry, metabolic processes, molecular genetics, homeostasis, and population dynamics. Emphasis will be placed on achievement of the detailed knowledge and refinement of skills needed for further study in various branches of the life sciences and related fields

OVERALL CURRICULUM EXPECTATIONS

A. SCIENTIFIC INVESTIGATION SKILLS AND CAREER EXPLORATION

Overall Expectations

Throughout this course, students will:

1. . 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);
2. . identify and describe careers related to the fields of science under study, and describe contributions of scientists, including Canadians, to those fields.

B. BIOCHEMISTRY

Overall Expectations

By the end of this course, students will:

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

C. METABOLIC PROCESSES

Overall Expectations

By the end of this course, students will:

1. 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;
2. investigate the products of metabolic processes such as cellular respiration and photosynthesis;
3. demonstrate an understanding of the chemical changes and energy conversions that occur in metabolic processes.

D. MOLECULAR GENETICS

Overall Expectations

By the end of this course, students will:

1. analyse some of the social, ethical, and legal issues associated with genetic research and biotechnology;
2. investigate, through laboratory activities, the structures of cell components and their roles in processes that occur within the cell;

3. demonstrate an understanding of concepts related to molecular genetics, and how genetic modification is applied in industry and agriculture.

E. HOMEOSTASIS

Overall Expectations

By the end of this course, students will:

1. evaluate the impact on the human body of selected chemical substances and of environmental factors related to human activity;
2. investigate the feedback mechanisms that maintain homeostasis in living organisms;
3. 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

Overall Expectations

By the end of this course, students will:

1. 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;
2. investigate the characteristics of population growth, and use models to calculate the growth of populations within an ecosystem;
3. demonstrate an understanding of concepts related to population growth, and explain the factors that affect the growth of various populations of species.

UNIT, DESCRIPTION AND TIME

Unit	Titles and Descriptions	Time Frame
1	<p>Biochemistry:</p> <p>Review of Bonding: Intramolecular and Intermolecular Properties of water Functional groups Acids, Bases and Buffers Carbohydrates, Lipids, Proteins and Nucleic Acids Enzymes: induced fit and Lock and Key theories; factors affecting enzyme activity, co-factors, co-enzymes, applications of enzyme activity in the food and pharmaceutical industries Allosteric inhibition, competitive inhibition and feedback inhibition Biological reactions: dehydration synthesis, hydrolysis, neutralization, redox reactions, anabolic and catabolic reactions Cellular organelles Structure of cell membrane: Fluid mosaic model Passive transport: diffusion and osmosis Active transport: Exocytosis, endocytosis, receptor mediated endocytosis</p>	26 hrs.
2	<p>Metabolic Processes:</p> <p>Laws of thermodynamics Oxidative phosphorylation and substrate-level phosphorylation Stages of cellular respiration: glycolysis, pyruvate oxidation, Krebs' Cycle and electron</p>	20 hrs.

	<p>transport chain Anaerobic respiration: Lactic acid fermentation and ethanol fermentation Alternate pathways: lipid and protein catabolism VO₂ max Light and accessory pigments Structure of leaf Guard cells and control of stomata Visible light, absorption spectrum and action spectrum Chlorophyll Photosystems and photophosphorylation Light dependent reactions: cyclic and non-cyclic electron flow Light-independent reactions Chromatography</p>	
3	<p>Molecular Genetics: History of discovery of structure of DNA DNA Experiments: Hershey and Chase, Oswald and Avery DNA replication Structure of RNA <i>Protein Synthesis</i> Protein Synthesis: Central Dogma, Transcription, Translation, Post-transcriptional modifications Control of gene expression: lac and trap Operons Mutations: point mutations, frameshift mutations BLAST: Basic Local Alignment Search Tool Chromosomal structure <i>Biotechnology</i> Restriction enzymes Gel electrophoresis and practical applications Recombinant DNA technology Social, ethical and legal implications</p>	26 hrs.
4	<p>Homeostasis: Negative and positive feedback loops Thermoregulation Urinary system Osmoregulation <i>Chemical Signals Maintain Homeostasis</i> Endocrine system Hormones Factors affecting blood sugar Metabolism Adjustments to Stress <i>How Nerve Signals Maintain Homeostasis</i> Central nervous system Brain: parts and function Neurons Reflexes and reflex arc Electrochemical impulse Synaptic transmission Autonomic nervous system Sympathetic vs. parasympathetic nervous system</p>	26 hrs.
5	<p>Population Dynamics: <i>Population Ecology</i> Population density; patterns of dispersion Random sampling techniques: quadrat and mark-recapture</p>	10 hrs.

	Types of interaction between species Population growth models: geometric, exponential, logistic Carrying capacity	
6	Final Evaluation	2
	Total	110 hours

STRATEGIES FOR ASSESSMENT AND EVALUATION OF STUDENT PERFORMANCE:

Assessment as Learning	Assessment for Learning	Assessment of Learning
<p style="text-align: center;">Student Product</p> <p>-Learning Logs (anecdotal) Quizzes (scale/rubric)</p>	<p style="text-align: center;">Student Product</p> <p>Assignment Quizzes (scale/rubric) Reports(rubric) Entrance Ticket/Exit Card</p>	<p style="text-align: center;">Student Product</p> <p>Assignment(s) Tests(scale/rubric) Exam (marking scheme) Research Reports(rubric) Lab report</p>
<p style="text-align: center;">Observation</p> <p>Peer feedback Daily website work Goal setting/Revising</p>	<p style="text-align: center;">Observation</p> <p>Whiteboard work Class Discussions (anecdotal) PowerPoint presentations (rubric)</p>	<p style="text-align: center;">Observation</p> <p>PowerPoint presentation (rubric) Lab report investigation process(checklist)</p>
<p style="text-align: center;">Conversation</p> <p>Small Group Discussions (checklist) Pair work (checklist) Conferencing</p>	<p style="text-align: center;">Conversation</p> <p>Small Group Discussions (checklist) Pair work (checklist) Peer feedback (anecdotal) Oral quizzes (scale/rubric)</p>	<p style="text-align: center;">Conversation</p> <p>Question and Answer Sessions(checklist) Oral tests (scale/rubric) Conversation to probe product pieces</p>

TEACHING AND LEARNING STRATEGIES

Along with some of the strategies noted in the assessment for, as, and of learning charts below, strategies will include (but not limited to):

- Lecture
- Discussion
- Problem posing
- demonstration
- Mathematical problem solving
- Homework
- Assignment
- Investigative Inquiry
- Lab report

ASSESSMENT STRATEGIES

- | | | | |
|-------------------|------------------|--------------|-------------------------|
| Quiz | Report | Presentation | Extended Investigations |
| Test (diagnostic) | Skills Checklist | Interview | Project |

THE FINAL GRADE

Percentage of Final Mark	Weight	Evaluation Categories	Assessment will be ongoing to inform the students of their performance and the opportunity for success. Four achievement categories are illustrated in the chart.
70%	50%	Tests, Poster and quizzes	
	20%	Lab	
30%	10%	Scientific Writing	K: Knowledge and Understanding 30% I: Inquiry/Thinking 25% C: Communication 25% MC: Making Connections/Application 20%
	20%	Final Project/Culminating Task	

REFERENCES

[1] Biology 12, by Nelson Education Ltd, 2012.

[2] The Ontario Curriculum Grade 11 and 12 Science

http://www.edu.gov.on.ca/eng/curriculum/secondary/2009science11_12.pdf

Learning Skills: **ACHIEVEMENT CHART: SCIENCE, GRADES 9-12**

Category	50-59% (Level 1)	60-69% (Level 2)	70-79% (Level 3)	80-100% (Level 4)
Knowledge and Understanding - Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)				
	The student:			
understanding of concepts, principles, laws, and theories (e.g., identifying assumptions; eliminating misconceptions; providing explanations)	demonstrates limited understanding of concepts, principles, laws, and theories	demonstrates some understanding of concepts, principles, laws, and theories	demonstrates considerable understanding of concepts, principles, laws, and theories	demonstrates thorough understanding of concepts, principles, laws, and theories
knowledge of facts and terms	demonstrates limited knowledge of facts and terms	demonstrates some knowledge of facts and terms	demonstrates considerable knowledge of facts and terms	demonstrates thorough knowledge of facts and terms
transfer of concepts to new contexts	infrequently transfers simple concepts to new contexts	sometimes transfers simple concepts to new contexts	usually transfers simple concepts to new contexts	routinely transfers simple concepts to new contexts
understanding of relationships between concepts	demonstrates limited understanding of relationships between	demonstrates some understanding of relationships between	demonstrates considerable understanding of	demonstrates thorough and insightful

	concepts	concepts	relationships between concepts	understanding of relationships between concepts
Thinking and Inquiry - The use of critical and creative thinking and inquiry skills and/or processes				
	The student:			
application of the skills and strategies of scientific inquiry (e.g., initiating and planning, performing and recording, analysing and interpreting, problem solving)	applies few of the skills and strategies of scientific inquiry	applies some of the skills and strategies of scientific inquiry	applies most of the skills and strategies of scientific inquiry	applies all or almost all of the skills and strategies of scientific inquiry
application of technical skills and procedures (e.g., microscopes)	applies technical skills and procedures with limited competence	applies technical skills and procedures with moderate competence	applies technical skills and procedures with considerable competence	applies technical skills and procedures with a high degree of competence
use of tools, equipment, and materials	uses tools, equipment, and materials safely and correctly only with supervision	uses tools, equipment, and materials safely and correctly with some supervision	uses tools, equipment, and materials safely and correctly	demonstrates and promotes the safe and correct use of tools, equipment, and materials
Communication - The conveying of meaning through various forms				
	The student:			
communication of information and ideas	communicates information and ideas with limited clarity and precision	communicates information and ideas with some clarity and precision	communicates information and ideas with considerable clarity and precision	communicates information and ideas with a high degree of clarity and precision
use of scientific terminology, symbols, conventions, and standard (SI) units	uses scientific terminology, symbols, conventions, and SI units with limited accuracy and effectiveness	uses scientific terminology, symbols, conventions, and SI units with some accuracy and effectiveness	uses scientific terminology, symbols, conventions, and SI units with considerable accuracy and effectiveness	uses scientific terminology, symbols, conventions, and SI units with a high degree of accuracy and effectiveness
communication for different audiences and purpose	communicates with a limited sense of audience and purpose	communicates with some sense of audience and purpose	communicates with a clear sense of audience and purpose	communicates with a strong sense of audience and purpose
use of various forms of communication (e.g., reports, essays)	demonstrates limited command of the various forms	demonstrates moderate command of the various forms	demonstrates considerable command of the various forms	demonstrates extensive command of the various forms
use of information technology for scientific purposes (e.g., specialized databases)	uses technology with limited appropriateness and effectiveness	uses technology with moderate appropriateness and effectiveness	uses appropriate technology with considerable effectiveness	uses appropriate technology with a high degree of effectiveness
Application - The use of knowledge and skills to make connections within and between various contexts				
	The student:			
understanding of connections among science, technology,	shows limited understanding of connections in familiar	shows some understanding of connections in familiar	shows considerable understanding of connections in familiar	shows thorough understanding of connections in familiar

society, and the environment	contexts	contexts	and some unfamiliar contexts	and unfamiliar contexts
analysis of social and economic issues involving science and technology	analyses social and economic issues with limited effectiveness	analyses social and economic issues with moderate effectiveness	analyses social and economic issues with considerable effectiveness	analyses complex social and economic issues with a high degree of effectiveness
assessment of impacts of science and technology on the environment	assesses environmental impacts with limited effectiveness	assesses environmental impacts with moderate effectiveness	assesses environmental impacts with considerable effectiveness	assesses environmental impacts with a high degree of effectiveness
proposing of courses of practical action in relation to science and technology-based problems	extends analyses of familiar problems into courses of practical action with limited effectiveness	extends analyses of familiar problems into courses of practical action with moderate effectiveness	extends analyses of familiar problems into courses of practical action with considerable effectiveness	extends analyses of familiar and unfamiliar problems into courses of practical action with a high degree of effectiveness

LEARNING SKILLS

Learning Skills are skills and habits are essential to success in school and in the workplace. Teachers report achievement on the six Learning Skills in the table below using letter codes:

E = Excellent

G = Good

S = Satisfactory

N = Needs Improvement.

Learning Skills	Sample Behaviors
Responsibility	The student fulfils responsibilities and commitments within the learning environment; completes and submits class work, homework, and assignments according to agreed-upon timelines; takes responsibility for and manages own behavior.
Organization	The student devises and follows a plan and process for completing work and tasks; establishes priorities and manages time to complete tasks and achieve goals; identifies, gathers, evaluates, and uses information, technology, and resources to complete tasks.
Independent Work	The student independently monitors, assesses, and revises plans to complete tasks and meet goals; uses class time appropriately to complete tasks; follows instructions with minimal supervision.
Collaboration	The student accepts various roles and an equitable share of work in a group; responds positively to the ideas, opinions, values, and traditions of others; builds healthy peer-to-peer relationships through personal and media-assisted interactions; works with others to resolve conflicts and build consensus to achieve group goals; shares information, resources, and expertise and promotes critical thinking to solve problems and make decisions.
Initiative	The student looks for and acts on new ideas and opportunities for learning; demonstrates the capacity for innovation and a willingness to take risks; demonstrates curiosity and interest in learning; approaches new tasks with a positive attitude; recognizes and advocates appropriately for the rights of self and others.
Self-Regulation	The student sets own individual goals and monitors progress towards achieving them; seeks clarification or assistance when needed; assesses and reflects critically on own strengths, needs, and interests; identifies learning opportunities, choices, and strategies to meet personal needs and achieve goals; perseveres and makes an effort when responding to challenges.

ACADEMIC HONESTY: CHEATING AND PLAGIARISM:

Plagiarism is a serious offense. It is defined as taking words, phrasing, sentence structure, or any other element of the expression of another person's **ideas**, and using them as if they were your own. Plagiarism is a violation of another person's rights, whether the material taken is excessive or small. Students will be assisted in developing strategies and techniques to avoid plagiarism. They need to be aware that plagiarized term work will be penalized and could result in a mark of zero.

Assignment Policy, Missed Tests and Attendance: Please refer to Student Contract Form

PROGRAM PLANNING CONSIDERATIONS FOR SCIENCE

Teachers planning a program in Science must take into account considerations in a number of important areas. Essential information that pertains to all disciplines is provided in the companion piece to this document, *Science. The Ontario Curriculum, Grades 11 and 12: Some Considerations for Program Planning, 2008*. The areas of concern to all teachers include the following:

The Role of Technology in the Curriculum. Using information technology will assist students in the achievement of many of the expectations in the curriculum regarding research, written work, analysis of information, and visual presentations.

English As a Second Language (ESL): Appropriate accommodations in teaching, learning, and evaluation strategies will be made to help ESL students gain proficiency in English, since students taking ESL at the secondary level have limited time in which to develop this proficiency.

Career Education: Expectations in this course include many opportunities for students to explore educational and career options, and to become self-directed learners.

Health and Safety in Science

Environmental Education

Critical Thinking and Critical Literacy in Science

Literacy, Mathematical Literacy, and Investigation (Inquiry/Research) Skills