



Ontario Virtual Academy
Course Outline
2026 - 2027

Ministry of Education Course Title: Grade 12 Biology	
Ministry Course Code: SBI4U	
Course Type: University Preparation	
Grade: 12	
Credit Value: 1.0	
Prerequisite(s): SBI3U	
Department: Science	
Course Developed by: Ljubisa Mavrak	Date: June, 2026
Length: One Semester	Hours: 110
This course has been developed based on the following Ministry documents: 1. <i>Science, The Ontario Curriculum, Grades 11 and 12, (2008)</i> 2. <i>Growing Success: Assessment, Evaluation and Reporting in Ontario Schools (2010)</i> 3. <i>Learning for All (2013)</i>	

COURSE DESCRIPTION/RATIONALE

This course provides students with the opportunity for in-depth study of the concepts and processes that occur in 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 the achievement of detailed knowledge and the refinement of skills needed for further study in various branches of the life sciences and related fields.

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

OVERALL CURRICULUM EXPECTATIONS

Strand	Expectation (By the end of this course, students will:)
A. Scientific Investigation Skills and Career Exploration	A1. 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) A2. identify and describe careers related to the fields of science under study, and describe contributions of scientists, including Canadians, to those fields.
B. Biochemistry	B1. analyse technological applications of enzymes in some industrial processes, and evaluate technological advances in the field of cellular biology B2. investigate the chemical structures, functions, and chemical properties of biological molecules involved in some common cellular processes and biochemical reactions B3. demonstrate an understanding of the structures and functions of biological molecules, and the biochemical reactions required to maintain normal cellular function. dynamically, and to solve problems, in algebra and across the other strands
C. Metabolic Processes	C1. 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 C2. investigate the products of metabolic processes such as cellular respiration and photosynthesis C3. demonstrate an understanding of the chemical changes and energy conversions that occur in metabolic processes.
D. Molecular Genetics	D1. analyse some of the social, ethical, and legal issues associated with genetic research and biotechnology D2. investigate, through laboratory activities, the structures of cell components and their roles in processes that occur within the cell; D3. demonstrate an understanding of concepts related to molecular genetics, and how genetic modification is applied in industry and

	agriculture
E. Homeostasis	E1. evaluate the impact on the human body of selected chemical substances and of environmental factors related to human activity E2. investigate the feedback mechanisms that maintain homeostasis in living organisms E3. 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	F1. 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 F2. investigate the characteristics of population growth, and use models to calculate the growth of populations within an ecosystem F3. 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
Unit 1: Biochemistry	23 hours
Unit 2: Metabolic Processes	23 hours
Unit 3: Molecular Genetics	22 hours
Unit 4: Homeostasis	22 hours
Unit 5: Population Dynamics	14 hours
Unit 6: Cumulative Assessments (Final Project and Final Exam)	6 hours
Total	110 Hours

UNIT DESCRIPTIONS

Unit 1: Biochemistry

In this unit, students will identify chemical structures, functions, and chemical properties of biological molecules involved in some common cellular processes and biochemical reactions and understand the importance of these in the maintenance of normal cellular function. Students will also analyse technological applications related to enzyme activity in the food and pharmaceutical industries.

Unit 2: Metabolic Processes

In this unit, students will identify and describe the cellular organelles involved in cellular respiration and photosynthesis, and the various metabolic reactions taking place during these processes and will understand the importance of these reactions in the maintenance of normal cellular function. Students will also analyze medical and technological applications related to cellular respiration and photosynthesis.

Unit 3: Molecular Genetics

In this unit, students will identify key scientific contributions leading to the discovery of DNA and DNA function, and describe the key events in DNA replication and protein synthesis with an emphasis on the impacts of mutations on protein function and disease. Students will also analyze common biotechnological tools and applications related to molecular genetics.

Unit 4: Homeostasis

In this unit, students will identify key components of the nervous, endocrine and excretory system, and describe their role in maintaining homeostasis and how select chemical substances and environmental factors affect these processes. Students will also assess the impact of various drugs on homeostatic mechanisms.

Unit 5: Population Dynamics

In this unit, students will demonstrate an understanding of concepts related to population growth, and explain the factors that affect the growth of various populations of species, use models to calculate the growth of populations and analyze the relationships between population growth, personal consumption, technological development, and our ecological footprint. Students will also assess the impact of human population growth on the sustainability of resources for future generations.

TEACHING AND LEARNING STRATEGIES

In this course, students will experience the following activities:

Presentations with embedded videos are utilized to outline concepts, explain theory with the use of examples and practice questions, and incorporate multi-media opportunities for students to learn more (e.g. online simulations, quizzes, etc.).

End of unit conversations and Poodlls are opportunities for students to express their ideas, problem solving, and thought processes with a teacher who provides timely feedback.

Reflection is an opportunity for students to look back at concepts and theories with new eyes, to relate theory to practice, and to align learning with their own values and beliefs.

Discussions with the instructor are facilitated through video conferencing, discussing the concepts and skills being studied. This enables two-way communication between the student and the instructor, to share ideas and ask questions in dialogue. This also helps to build a relationship between the student and instructor.

Instructor demonstrations (research skills, etc.) are opportunities for the instructor to lead a student through a concept or skill through video conferencing, videos, or emailing with the student.

Discussion forums are an opportunity for students to summarize and share their ideas and perspectives with their peers, which deepens understanding through expression. It also provides an opportunity for peer-to-peer feedback.

Practical extension and application of knowledge are integrated throughout the course. The goal is to help students make connections between what they learn in the classroom and how they understand and relate to the world around them and their own lives. Learning becomes a dynamic opportunity for students to be more aware that their learning is all around them and enable them to create more meaning in their lives.

Individual activities/assignments assessments are completed individually at a student's own pace and are intended to expand and consolidate the learning in each lesson. Individual activities allow the teacher to accommodate interests and needs and to assess the progress of individual students. For this reason, students are encouraged to discuss IEPs (Individual Education Plans) with their teacher and to ask to modify assessments if they have a unique interest that they feel could be

pursued in the assessment. The teacher plays an important role in supporting these activities by providing ongoing feedback to students, both orally and in writing.

Research is an opportunity to apply inquiry skills to a practical problem or question. Students perform research to gather information, evaluate quality sources, analyze findings, evaluate their analysis, and synthesize their findings into conclusions. Throughout, students apply both creative thinking and critical thinking. New questions are also developed to further learning.

Writing as a learning tool helps students to think critically about course material while grasping, organizing, and integrating prior knowledge with new concepts. Good communication skills are important both in and out of the classroom.

Virtual simulations are interactive websites that provide students with an opportunity to ask questions, explore hypotheses, relate variables, examine relationships, and make connections between theory and application in a safe environment that promotes intellectual risk taking and curiosity.

Virtual labs are interactive websites that provide students with an opportunity to follow a procedure to test hypotheses using scientific apparatus, gather and record observations, analyze observations using formula and relevant theory/concepts, and then formulate conclusions that relate hypotheses to analysis.

Diagrams are visual representations of scientific ideas and concepts. They provide another perspective to organize ideas. Visuals are thought to promote cognitive plasticity - meaning, they can help us change our minds or help us to remember an idea.

Graphics/images are visual representations of ideas/concepts. Visuals are thought to promote cognitive plasticity - meaning, they can help us change our minds or help us to remember an idea.

Charts are visual representations of scientific ideas and concepts using math that support analysis. For example, you can have a pie chart that shows Canada's energy sources.

Tables involve organizing information in terms of categories (rows and columns). This helps us to understand the relationships between ideas and data, as well as highlight trends.

Drawings and schematics are scientific and engineering ideas explained visually. For example, an electric circuit can be explained using symbols, which makes it possible to communicate ideas universally, clearly, and succinctly.

Articles are examples of concepts and theories being discussed in the public realm and with respect to current events. They are snapshots not only of why scientific theories/concepts/applications are relevant but also provide a window into the broader context of scientific knowledge and understanding. Students learn through reading and analysis that science is deeply related to, and intertwined with, society and the diverse perspectives of lived experience.

Cases are summaries of real-life problems wherein students relate scientific theories/concepts/formulas towards solving the problem in a real-world context. This helps students to understand the application and use of knowledge.

Maps are visual representations that relate scientific ideas/concepts/applications to geographic data. For example, we can understand that based on how the earth revolves around the sun and rotates on its axis, different areas of the world see the sun rise and set at different times. We can plot this data on a map to show time zones.

Practice problems provide students with a scenario/problem to solve by applying concepts and skills learned in a context. This helps students to understand the relevance of their learning.

Design projects are an opportunity for students to put their learning to the test in a real-world scenario, to address a design problem with a direct connection to people, the environment, economics, etc. Students collect information, apply problem solving, and use critical thinking to develop practical solutions that directly address their design problems.

ASSESSMENT, EVALUATION, AND REPORTING

Assessment: The process of gathering information that accurately reflects how well a student is achieving the identified curriculum expectations. Teachers provide students with descriptive feedback that guides their efforts towards improved performance.

- In assessment for learning (AFL), teachers provide students with descriptive feedback and coaching for improvement.
- In assessment as learning (AAL), teachers help students develop their capacity to be independent, autonomous learners who are able to set individual goals, monitor their own progress, determine next steps, and reflect on their thinking and learning.

Evaluation: Assessment of Learning (AOL) focuses on evaluation which is the process of making a judgement about the quality of student work on the basis of established criteria over a limited, reasonable period of time.

Reporting: Involves communicating student achievement of the curriculum expectations and Learning Skills and Work Habits in the form of marks and comments as determined by the teacher's use of professional judgement.

STRATEGIES FOR ASSESSMENT

A number of assessments are used throughout the unit, typically one per lesson. Students are urged to complete each assessment fully to truly test their knowledge and understanding of concepts. This provides the teacher with an opportunity to provide feedback that can improve a student's learning (AFL/AOL) and evaluate it (AOL). Students are encouraged to ask the teacher if they have questions relating to an assessment, especially an AOL to ensure that the student receives the best mark possible. Assessment practices can nurture a student's sense of progress and provide a motivation for continued learning. A variety of assessment designs are incorporated in each unit, to ensure that students are learning and assessing their learning in a variety of ways. Rubrics and marking schemes are outlined where appropriate, and students are encouraged to self-evaluate their work using these tools.

ASSESSMENT ACTIVITIES

- ☐ True and false questions
- ☐ Definition questions
- ☐ Fill in the blank (e.g. with tables) questions
- ☐ Short answer questions
- ☐ Long answer questions
- ☐ Reflections
- ☐ Graphs - plotting and analyzing
- ☐ Drawings / diagrams / sketches / schematics - creating, labeling, and analyzing
- ☐ Problem solving calculations
- ☐ Lab reports
- ☐ Simulation, lab, and case study worksheets
- ☐ Research projects and reports
- ☐ Design projects and reports
- ☐ End of unit conversations (google meets)
- ☐ End of unit podcast elevator pitches (1 minute speech recording)
- ☐ Final exam

EVALUATION

The final grade will be determined as follows:

- **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 will be given to more recent evidence of achievement.
- **Thirty Percent** of the grade will be based on a final evaluation administered at the end of the course. This evaluation will be based on evidence from a final project and final exam, both comprehensive of the course. The final evaluation is an opportunity for the students 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)

TERM WORK EVALUATIONS (70%)

Evaluation Item	Description	Category	Weight
Unit 1 quiz	Quiz on carbohydrates and lipids	K	14
Unit 1 research report	Students will conduct research on an enzyme of their choice and report their findings in a paper	T, C, A	
Unit 1 test	Students will complete a Unit Test	K, T, C, A	
Unit 2 quiz	Cellular Respiration	K	14
Unit 2 photosynthesis poster - mindmap	Students will create a poster involving the various processes within photosynthesis	K, T, C, A	
Unit 2 interview conference	Students will conduct a 1-on-1 interview with their teacher to demonstrate their learning	T, C, A	
Unit 2 Test	Students will complete a Unit Test	K, T, C, A	
Unit 3 DNA extraction lab	Students will conduct a live lab and answer follow-up questions about the lab	A	14
Unit 3 transcription/translation comic/video	Students will create a visual representation of DNA replication	K, T, C, A	
Unit 3 test	Students will complete a Unit Test	K, T, C, A	
Unit 4 - T/I assignment	Students will answer a Thinking and Inquiry assignment	T, C	14
Unit 4 - Sheep Brain Dissection virtual	Students will conduct a virtual lab of a sheep brain dissection and complete follow-up questions	A	
Unit 4 - breathing rate lab	Students will conduct a live lab and answer follow-up questions about the lab	T, C, A	
Unit 4 - news report - effect of a specific drug	Students will create a news report or presentation on the effects a particular drug has on homeostasis	K, T, C, A	
Unit 5 quiz	Quiz on population dynamics	K	14
Unit 5 Measuring	Students will conduct a live lab and answer follow-up questions		

Populations Assignment	about the lab	T, C, A	
Unit 5 Test	Students will complete a Unit Test	K, T, C, A	

FINAL EVALUATIONS (30%)

Final Project	Students will complete an interdisciplinary culminating project	K, T, C, A	10
Final Exam	Students will complete this proctored two hour exam that addresses all units in the course.	K, T, C, A	20

Weightings	
Course Work	70
Knowledge/Understanding (K)	17.5
Thinking/Inquiry (T)	17.5
Communication (C)	17.5
Application (A)	17.5
Final	30
Exam (5K, 5T, 5C, 5A)	20
Culminating Project (2.5K, 2.5T, 2.5C, 2.5A)	10

AFL/AAL/AOL TRACKING SHEET

Unit 1: Biochemistry

AAL	AFL	AOL
Checkpoint questions	Formative quiz - chemistry fundamentals	Unit 1 quiz
Carbohydrates discussion	Identifying nutrients gizmo	Unit 1 research report
Learning Log	Mock interview	Unit 1 test

Unit 2: Metabolic Processes

AAL	AFL	AOL
Checkpoint questions	Formative quiz - metabolic processes	Unit 2 quiz
Photosynthesis discussion	Cellular respiration and photosynthesis gizmo	Unit 2 photosynthesis poster - mindmap
Learning skills and work habits self-assessment	Study skills diagrams study sheet	Unit 2 interview conference
		Unit 2 Test

Unit 3: Molecular Genetics

AAL	AFL	AOL
Checkpoint questions	DNA profiling gizmo	Unit 3 DNA extraction lab
Practice problems worksheets		Unit 3 transcription/translation comic/video
Mutations discussion		Unit 3 test
Learning Log		

Unit 4: Homeostasis

AAL	AFL	AOL
Checkpoint questions	Formative quiz - nervous system	Unit 4 - T/I assignment
Practice problems worksheets	Formative quiz - endocrine system	Unit 4 - Sheep Brain Dissection virtual
Homeostasis discussion	Homeostasis gizmo	Unit 4 - Breathing rate lab
Learning Log		Unit 4 - news report - effect of a specific drug

Unit 5: Population Dynamics

AAL	AFL	AOL
Checkpoint questions	Study skills making practice questions	Unit 5 quiz
Practice problems worksheets		Unit 5 Measuring Populations Assignment
Population dynamics discussion		Unit 5 Test
Learning skills and work habits self-assessment		

Unit 6: Cumulative Assessments

AAL	AFL	AOL
	End-of-course conference	Final project
		Final exam

CONSIDERATION FOR PROGRAM PLANNING PLANNING**PROGRAMS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS**

Classroom teachers are the key educators of students who have special education needs. They have a responsibility to help all students learn, and they work collaboratively with special education teachers, where appropriate, to achieve this goal.

Special Education Transformation: The Report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006 endorses a set of beliefs that should guide program planning for students with special education needs in all disciplines. Those beliefs are as follows: All students can succeed. Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students. Successful instructional practices are founded on evidence-based research, tempered by experience.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS

Ontario schools have some of the most multilingual student populations in the world. The first language of approximately 20 percent of the students in Ontario's English language schools is a language other than English. Ontario's linguistic heritage includes several Aboriginal languages; many African, Asian, and European languages; and some varieties of English, such as Jamaican Creole. Many English language learners were born in Canada and raised in families and communities in which languages other than English were spoken, or in which the variety of English spoken differed significantly from the English of Ontario classrooms. Other English language learners arrive in Ontario as newcomers from other countries; they may have experience of highly sophisticated educational systems, or they may have come from regions where access to formal schooling was limited. When they start school in Ontario, many of these students are entering a new linguistic and cultural environment.

THE ROLE OF TECHNOLOGY IN THE PROGRAM

Information and communications technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' language learning. ICT tools include multimedia resources, databases, Internet websites, digital cameras, and word-processing programs. Tools such as these can help students to collect, organize, and sort the data they gather and to write, edit, and present reports on their findings. Information and communications technologies can also be used to connect students to other schools, at home and abroad, and to bring the global community into the local classroom. Whenever appropriate, therefore, students should be encouraged to use ICT to support and communicate their learning.

ACCOMMODATIONS

Accommodations will be based on meeting with parents, teachers, administration and external educational assessment reports. The following three types of accommodations may be provided:

- ☐ **Instructional accommodations:** such as changes in teaching strategies, including styles of presentation, methods of organization, or use of technology and multimedia.
- ☐ **Assessment accommodations:** such as allowing additional time to complete tests or assignments or permitting oral responses to test questions.

Other examples of modifications and aids, which may be used in this course, are:

- ☐ Provide step-by-step instructions.
- ☐ Help students create organizers for planning writing tasks.
- ☐ Allow students to report verbally to a scribe (teacher/ student) who can help in note taking.
- ☐ Permit students a range of options for reading and writing tasks.
- ☐ Where an activity requires reading, provide it in advance.
- ☐ Provide opportunities for enrichment.