



**Ontario eSecondary School  
Course Outline  
2024-2025**

<b>Ministry of Education Course Title: Biology 12, University Preparation</b>	
<b>Ministry Course Code: SBI4U</b>	
<b>Course Type: University Preparation</b>	
<b>Grade: 12</b>	
<b>Credit Value: 1.0</b>	
<b>Prerequisite(s): SBI3U, Grade 11, University Preparation</b>	
<b>Department: Science</b>	
<b>Course developed by:</b> Quan Ly	<b>Date: August, 2024</b> <b>Revised:</b>
<b>Length:</b> One Semester	<b>Hours:</b> 110
This course has been developed based on the following Ministry documents: <ol style="list-style-type: none"> <li>1. <a href="#"><i>Science, The Ontario Curriculum, Grades 11 and 12, (2008)</i></a></li> <li>2. <a href="#"><i>Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)</i></a></li> <li>3. <a href="#"><i>Learning for All (2013)</i></a></li> </ol>	

## **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.

## **OVERALL CURRICULUM EXPECTATIONS**

### **Scientific Investigation Skills and Career Exploration**

By the end of the course, students will:

- 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)

### **Biochemistry**

By the end of this course, 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.
- analyze technological applications related to enzyme activity in the food and pharmaceutical industries

### **Metabolic Processes**

By the end of this course, 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.
- analyze medical and technological applications related to cellular respiration and photosynthesis

### **Molecular Genetics**

By the end of this course, 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 impacts of mutations on protein function and disease.
- analyze common biotechnological tools and applications related to molecular genetics

### **Homeostasis**

By the end of this course, students will:

- 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.
- will assess the impact of various drugs on homeostatic mechanisms

### **Population Dynamics**

By the end of this course, 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.
- assess the impact of human population growth on the sustainability of resources for future generations

## COURSE CONTENT

<i>Unit</i>	<i>Length</i>
Unit 1: Biochemistry	23 hours
Unit 2: Metabolic Processes	23 hours
Unit 3: Molecular Genetics	23.5 hours
Unit 4: Homeostasis	22.5 hours
Unit 5: Population Dynamics	13 hours
Unit 6: Cumulative Assessments (Final Project and Final Exam)	
<b>Total</b>	<b>110 Hours</b>
	<b>3 Hour Culminating Task</b>
	<b>2 Hour Exam</b>

## 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.

**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.

**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.

**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.

**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.

**Readings** are an opportunity for students to gain insight from a variety of texts online and further develop literacy skills. Students may print out the reading material to use it to highlight, take notes, and have with them when a computer is not available.

**Oral presentations** in an online environment are opportunities for students to present live or record presentations, expressing their ideas and understanding orally.

**Reflective/comparative analysis and evaluation of written work** is very important in this course. Concepts and skills are modelled in examples (exemplars), which students can refer to and utilize to self-evaluate their own work. A variety of texts are shared, and students are encouraged to make comparisons with different texts, real life situations, and their own writing.

## 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. These assessments are not for marks.

- 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

Assessment practices can nurture students' sense of progress and competency and information instruction. Many diagnostic tools, e.g. checklists, are used at regular intervals throughout the units to encourage students' understanding of their current status as learners and to provide frequent and timely reviews of their progress. Assessment of student acquisition of learning skills also occurs regularly through unobtrusive teacher observation and conferencing.

Teachers are encouraged to share goals with students early in the course and to connect unit learning experiences frequently and explicitly with big ideas, overall expectations, and performance tasks. The teacher is encouraged to involve students in the discussion, modification, or creation of rubrics, and teach students to use rubrics as a learning tool.

## ASSESSMENT ACTIVITIES

- Discussion forums

- Diagnostic tests
- Video assignment
- Tests and quizzes
- Reflections
- Graphs - plotting and analyzing
- Drawings / diagrams / sketches / schematics - creating, labeling, and analyzing
- Problem solving calculations
- Lab reports
- Virtual labs
- Research projects and reports
- End of unit conversations (Google Meets)
- Final exam

## EVALUATION

The final grade will be determined as follows:

- 70% 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.
- 30% 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 student 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)*

Weight	
<b>Course Work</b>	<b>70</b>
Knowledge/Understanding (K)	22
Thinking/Inquiry (T)	16
Communication (C)	13.5
Application (A)	18.5
<b>Final</b>	<b>30</b>
Culminating Project (20T, 10C, 20A)	10
Exam (60K, 10T, 10C, 20A)	20

## TERM WORK EVALUATIONS (70%)

Evaluation Item	Description	Category	Weight
Unit 1.4 Carbohydrates and Lipids Quiz	Students will complete a quiz based on Lessons 1.3 and 1.4	K	14%
Unit 1.7 Research Report	Students will conduct research on an enzyme of their choice and report their findings in a paper	T, C, A	
Unit 1.10 Test	Students will complete a Unit Test	K, T, C, A	

Unit 2.5 Cellular Respiration Quiz	Students will complete a quiz based on Lessons 2.3, 2.4 and 2.5	K	14%
Unit 2.8 Photosynthesis Quiz	Students will complete a quiz based on Lessons 2.6, 2.7, and 2.8	K	
Unit 2.10 Interview	Students will conduct a 1-on-1 interview with their teacher to demonstrate their learning	T, C, A	
Unit 2.10 Test	Students will complete a Unit Test	K, T, C, A	
Unit 3.1 DNA Extraction Lab	Students will conduct a live lab and answer follow-up questions about the lab	A	5%
Unit 3.2 DNA Replication Quiz	Students will complete a quiz based on Lessons 3.1 and 3.2	K	
Unit 3.5 Protein Synthesis Quiz	Students will complete a quiz based on Lessons 3.3, 3.4 and 3.5	K	
Unit 3.7 Thinking and Inquiry Questions	Students will answer a Thinking and Inquiry assignment	T	
<b>Midpoint of the course</b>			
Unit 3.9 Video Assignment	Students will demonstrate their learning by creating a video explanation of one of the topics covered in this unit	K, C	11%
Unit 3.10 Test	Students will complete a Unit Test	K, T, C, A	
Unit 4.2 Sheep Brain Dissection	Students will conduct a virtual lab of a sheep brain dissection and complete follow-up questions	A	16%
Unit 4.3 Breathing Rate Lab	Students will conduct a live lab and answer follow-up questions about the lab	T, C, A	
Unit 4.9 Interview	Students will conduct a 1-on-1 interview with their teacher to demonstrate their learning	T, C, A	
Unit 4.9 Test	Students will complete a Unit Test	K, T, C, A	
Unit 5.1 Population Quiz	Students will complete a quiz based on Lesson 5.1	K	11%
Unit 5.2 Measuring Populations Assignment	Students will conduct a live lab and answer follow-up questions about the lab	T, C, A	
Unit 5.5 Test	Students will complete a Unit Test	K, T, C, A	

## FINAL EVALUATIONS (30%)

Evaluation Item	Description	Category	Weight
Final Project	Students will complete a interdisciplinary culminating project	T, C, A	10
Final Exam	Students will complete a Final Exam	K, T, C, A	20

## AAL/AFL/AOL TRACKING SHEET

### Unit 1: Biochemistry

<b>AAL</b>	<b>AFL</b>	<b>AOL</b>
Checkpoint Questions	Formative Quiz Chemistry Fundamentals	Carbohydrates and Lipids Quiz
Carbohydrates Discussion	Identifying Nutrients Gizmo	Enzyme Research Report
Learning Log	Mock Interview	Unit 1 Test
	Study Skills Mind Map	

### Unit 2: Metabolic Processes

<b>AAL</b>	<b>AFL</b>	<b>AOL</b>
Checkpoint Questions	Formative Quiz Metabolic Processes	Cellular Respiration Quiz
Photosynthesis Discussion	Cellular Respiration Gizmo	Photosynthesis Quiz
Learning Skills and Work Habits Self Assessment	Photosynthesis Gizmo	Interview
	Study Skills Diagrams Study Sheet	Unit 2 Test

### Unit 3: Molecular Genetics

<b>AAL</b>	<b>AFL</b>	<b>AOL</b>
Checkpoint Questions	DNA Profiling Gizmo	DNA Extraction Lab
Practice Problem Worksheets		DNA Replication Quiz
Mutations Discussion		Protein Synthesis Quiz
Learning Log		T&I Assignment
		Study Skills Video Assignment
		Unit 3 Test

### Unit 4: Homeostasis

<b>AAL</b>	<b>AFL</b>	<b>AOL</b>
Checkpoint Questions	Formative Quiz Nervous System	Sheep Brain Dissection
Practice Problem Worksheets	Formative Quiz Endocrine System	Breathing Rate Lab Report
Homeostasis Discussion	Homeostasis Gizmo	Interview
Learning Log	Study Skills Tables	Unit 4 Test

### Unit 5: Population Dynamics

<b>AAL</b>	<b>AFL</b>	<b>AOL</b>
Checkpoint Questions	Study Skills Making Practice Questions	Population Quiz
Practice Problem Worksheets		Measuring Population Assignment
Human Population Discussion		Unit 5 Test
Learning Skills and Work Habits Self Assessment		

### Unit 6: Cumulative Assessments

<b>AAL</b>	<b>AFL</b>	<b>AOL</b>
	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.