



Ontario eSecondary School Course Outline 2026-2027

Ministry of Education Course Title: Physics, Grade 12, University Preparation	
Ministry Course Code: SPH4U	
Course Type: University Preparation	
Grade: 12	
Credit Value: 1.0	
Prerequisite(s): Physics, Grade 11, University Preparation	
Department: Science	
Course developed by: George Murzaku	Date: September 1, 2017 Revised: May 30, 2019 Revised: August 1, 2026
Length: One Semester	Hours: 110
This course has been developed based on the following Ministry documents: 1. <i>The Ontario Curriculum, Grades 11 and 12 Science, Revised 2008</i> 2. <i>Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)</i>	

COURSE DESCRIPTION/RATIONALE

This course enables students to deepen their understanding of physics concepts and theories. Students will continue their exploration of energy transformations and the forces that affect motion, and will investigate electrical, gravitational, and magnetic fields and electromagnetic radiation. Students will also explore the wave nature of light, quantum mechanics, and special relativity. They will further develop their scientific investigation skills, learning, for example, how to analyse, qualitatively and quantitatively, data related to a variety of physics concepts and principles. Students will also consider the impact of technological applications of physics on society and the environment.

Units of Study	BIG IDEAS
Dynamics	- Forces affect motion in predictable and quantifiable ways. - Forces acting on an object will determine the motion of that object. - Many technologies that utilize the principles of dynamics have societal and environmental implications.
Energy and Momentum	- Energy and momentum are conserved in all interactions. - Interactions involving the laws of conservation of energy and conservation of momentum can be analysed mathematically. - Technological applications that involve energy and momentum can affect society and the environment in positive and negative ways.
Gravitational, Electric, and Magnetic Fields	- Gravitational, electric, and magnetic forces act on matter from a distance. - Gravitational, electric, and magnetic fields share many similar properties. - The behaviour of matter in gravitational, electric, and magnetic fields can be described mathematically. - Technological systems that involve gravitational, electric, and magnetic fields can have an effect on society and the environment.
The wave nature of light	- Light has properties that are similar to the properties of mechanical waves. - The behaviour of light as a wave can be described mathematically. - Technologies that use the principles of the wave nature of light can have societal and environmental implications.
Quantum mechanics and Relativity	- Light can show particle-like and wave-like behaviour, and particles can show wavelike behaviour. - The behaviour of light as a particle and the behaviour of particles as waves can be described mathematically. - Time is relative to a person's frame of reference. - The effects of relativistic motion can be described mathematically. - New theories can change scientific thought and lead to the development of new technologies.

COURSE CONTENT

<i>Unit</i>	<i>Length</i>
0: Skills Handbook	5 hours
1: Motion on a plane	31 hours
2: Work, Energy, and Momentum	21 hours
3: Gravitational, Electric, and Magnetic Field	23 hours
4: Wave Nature of Light	14 hours
5: Modern Physics	14 hours
Final Exam	2 hours

UNIT DESCRIPTIONS

Unit 0 - Skills handbook

Students will learn how to properly use significant digits in their measurements and problem solving situations. They will learn to use unit analysis techniques to verify the correctness of their solutions or derived formula in their lab activities. Students will learn how to analyze measurement errors quantitatively and qualitatively.

Unit 1 - Motion on a plane

Students will investigate, in qualitative and quantitative terms, forces involved in uniform circular motion and motion in a plane, and solve related problems. They will demonstrate an understanding of the forces involved in uniform circular motion and motion in a plane. Students will analyse technological devices that apply the principles of the dynamics of motion, and assess the technologies' social and environmental impact. Students will use critical thinking and inquiry skills to prepare, conduct, and write a lab investigation.

Unit 2 - Momentum and Energy

Students will investigate, in qualitative and quantitative terms, through laboratory inquiry or computer simulation, the relationship between the laws of conservation of energy and conservation of momentum, and solve related problems. They will demonstrate an understanding of work, energy, momentum, and the laws of conservation of energy and conservation of momentum, in one and two dimensions. Students will analyse, and propose ways to improve, technologies or procedures that apply principles related to energy and momentum, and assess the social and environmental impact of these technologies or procedures. Students will use critical thinking and inquiry skills to prepare, conduct, and write a lab investigation.

Unit 3- Gravitational, Electric, Magnetic Field

Students will investigate, in qualitative and quantitative terms, gravitational, electric, and magnetic fields, and solve related problems. They will demonstrate an understanding of the concepts, properties, principles, and laws related to gravitational, electric, and magnetic fields and their interactions with matter. Students will analyse the operation of technologies that use gravitational, electric, or magnetic fields, and assess the technologies' social and environmental impact. Students will use critical thinking and inquiry skills to prepare, conduct, and write a lab investigation.

Unit 4 - Wave Nature of Light

Students will investigate, in qualitative and quantitative terms, the properties of waves and light, and solve related problems. They will demonstrate an understanding of the properties of waves and light in relation to diffraction, refraction, interference, and polarization. Students will analyse technologies that use the wave nature of light, and assess their impact on society and the environment. They will use critical thinking and inquiry skills to prepare, conduct, and write a lab investigation.

Unit 5 - Modern Physics; Quantum mechanics and Relativity

Students will investigate special relativity and quantum mechanics, and solve related problems. They will demonstrate an understanding of the evidence that supports the basic concepts of quantum mechanics and Einstein's theory of special relativity. Students will analyse, with reference to quantum mechanics and relativity, how the introduction of new conceptual models and theories can influence and/or change scientific thought and lead to the development of new technologies. They will use critical thinking and inquiry skills to prepare, conduct, and write a lab investigation.

TEACHING AND LEARNING STRATEGIES

The students will experience a variety of activities:

Participation activities are seven standardized, course-wide prompts (Teach the Teacher, Concept in Action, Spot the Error, Concept Connections, Take a Position, Claim/Support/Question, and a culminating Course Takeaways video) embedded at set points throughout the course. They build metacognitive engagement with unit concepts and contribute to the course's participation grade.

Whole-Class Activities (facilitated through discussion forums, video presentations)

Whole class activities are designed to introduce concepts and skills that are directly applicable to the workplace and to build on the content being studied during small group and individual activities. These activities include the following:

Teacher demonstrations through video conferencing, email, or videos provided of a teacher or student demonstrating the concepts and skills being studied. This helps the student and teacher create an atmosphere of trust and respect to aid in the online learning environment.

Video presentations and technological aids with videos embedded to enrich the course content and clarify concepts and skills being studied. Also the use of online pre-approved quizzes and games to help a student become more familiar with the concepts and skills being studied.

Diagnostic and review activities (audio and video recordings) can be student-lead or teacher lead to work as a review for students through audio and video made to share among each other to help reinforce the concepts and skills being studied.

Small Group Activities

The teacher sets up small group activities to provide opportunities for active and oral learning as well as to bolster practical communication and teamwork skills. The teacher plays a critical role during group activities by monitoring group progress as well as answering questions that arise and using questions to assist students in their understanding. In this way, the teacher also facilitates student understanding of effective learning, communication, and team building during group activities.

The small group activities include the following:

Paired or small group research activities students are able to share their work online with not only their teachers, but their classmates too. Students are able to share resources through online chat and video

conferencing. The ability to learn from each other, work on teamwork skills, and practice communication are valued and encouraged throughout the course.

Comparison and evaluation of written work is very important in this course. This course focuses on giving many examples of correct work, and helping students build the skills needed to peer-correct and self-correct. Students are given a variety of texts to read through embedded links, to make comparisons with different texts, real life situations, and their own writing.

Practical extension and application of knowledge is used as an effective learning strategy in this course because it allows the students to read and listen to the texts and stories and reflect back with connections to themselves, other texts and the world. Students are encouraged to share their understandings through work submitted each day, phone conversations about course work, or videoconferencing.

Oral presentations in an online environment we have the equipment to have student either live video conference oral presentations, or make videos and submit them for their oral presentations. These oral presentations can be viewed by fellow students (when appropriate) and the teacher. Students can learn from one another, and from their teacher. Such activities include dramatic readings and performances.

Charts and graphs are used to present effective learning opportunities of concepts and skills to students who would benefit from visual objects to learn. Every student learns differently, and it is used to help students discover another way to present their information such as graphic organizers, lists, and pictures.

Individual Activities

The teacher should provide a variety of individual assignments to expand and consolidate the learning that takes place in the whole-class and small group activities. Individual activities allow the teacher to accommodate interests and needs and to access the progress of individual students. The teacher plays an important role in supporting these activities through the provision of ongoing feedback to the students, both orally and in writing. Teachers are encouraged to include individual activities such as the following in the course:

Research is completed in an online environment by teaching the students first about plagiarism rules and giving examples of good sources to use. The students are not only limited to the online search for information, but have the resources available by links on the Moodle page of information that has been scanned and uploaded.

Individual assignments are worked on at a student's own pace. The teacher can support the student in these activities with ongoing feedback.

Oral presentations are facilitated through the use of video conferencing and video recording.

Practical extension and application of knowledge helps students develop their own voice, and gives them the ability to make personal connections, and connections to the world throughout their course. Students are given a variety of reading and viewing texts to give them many chances to apply their new concepts, skills, and knowledge.

Ongoing project work is something that is valued in the earning of an English credit. The ongoing project can be submitted to the teacher for ongoing feedback in both written and oral work.

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.

Evaluation: Assessment of Learning 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.

Assessment & Evaluation at OES: Triangulation of Learning

In alignment with the Ontario Ministry of Education's *Growing Success* policy, student achievement across all high school courses at Ontario eSecondary School (OES) is evaluated through the **triangulation of evidence: observations, conversations, and student products**.

OES courses incorporate each of these evidence sources in a variety of ways to provide every student with equitable opportunities to demonstrate their learning:

- **Observations:** Collected through video recordings, interactive digital tools, learning logs, and synchronous task demonstrations.
- **Conversations:** Gathered via teacher-student conferences, oral defenses, virtual check-ins, and reflective feedback dialogues.
- **Products:** Demonstrated through major projects, essays, lab reports, performance tasks, and final assessments.

By evaluating a balanced variety of evidence, OES teachers apply professional judgment to ensure accurate, fair, and comprehensive assessment of each student's progress.

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

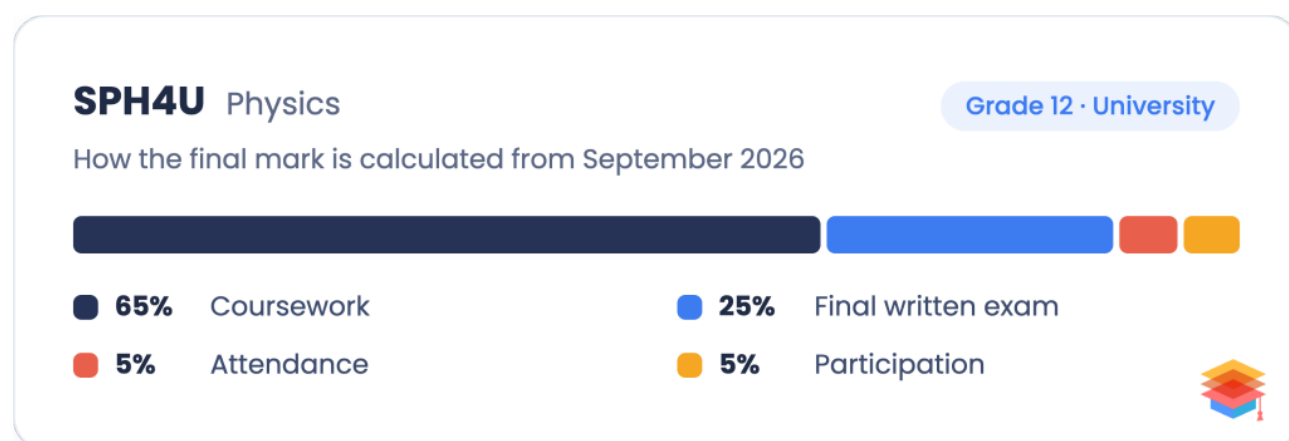
- ☐ Homework assignments
- ☐ Individual conference meetings
- ☐ Discussion Forums
- ☐ Diagnostic tests and writing tasks
- ☐ Completed Templates & Graphic Organizers
- ☐ Lab report
- ☐ Video Assignment
- ☐ Reflections
- ☐ Oral presentations & Active Listening
- ☐ Tests & Exam
- ☐ Evaluations

EVALUATION

The final grade will be determined as follows:

- ☐ 65% 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.
- ☐ 25% of the grade will be based on a final evaluation administered at the end of the course. This evaluation will be based on a final written examination, comprehensive of the course. The final evaluation is an opportunity for the student to demonstrate comprehensive achievement of the overall expectations for the course.
- ☐ 10% of the grade will be based on the student's attendance and participation throughout the course, assessed according to Ministry criteria.

(*Growing Success: Assessment, Evaluation and Reporting in Ontario Schools*. Ontario Ministry of



Education Publication, 2010 p.41)

TERM WORK EVALUATIONS (65%)

Evaluation Item	Description	Category	Weight
Reflective research projects	Research-based projects for each unit based on applications of learned concept/law to real life problems	K,T,C,A	10
Problem sets	Problem sets supplement lessons and are used to assess whether or not students are meeting criteria for success	K,T,C	11
Multiple Choice Conceptual Test	These tests will evaluate the ability of a student to tackle own misconceptions	K/T	11
Multiple Choice Quiz	Multiple choice quizzes will evaluate the understanding of the content learned	K/A	11

Simulations/Lab experiment/Live interview evaluations	Video Lab report and lab reports are used to evaluate students' thinking and communication skills Live interviews are used to evaluate students through observation and conversation.	T,C	11
Unit Test(s)	Unit tests are based on curriculum expectations and cover the entirety of each unit	K, A	11

FINAL EVALUATIONS (25%)

Evaluation Item	Description	Category	Weight
Final Exam	A final, written examination, covering all curriculum expectations for the course.	K,T,C,A	25

ATTENDANCE and PARTICIPATION (10%)

Attendance	Assessed according to the Ministry's attendance criteria (Growing Success, September 2026 update), based on the proportion of unexcused absences over the course.	5	5
Participation	Assessed according to the Ministry's participation criteria (Growing Success, September 2026 update), based on engagement in class discussions and activities throughout the course, including the standardized participation prompts (see Teaching and Learning Strategies).	5	5

AFL/AAL/AOL Tracking sheet:

Unit 0:

AAL	AFL	AOL
Lesson notes	Online quiz	Online Quiz
Discussion forum	Lesson Problem Set [Self-Check Answers]	
Gizmos Investigation		

Unit 1:

AAL	AFL	AOL
Discussion Forum	Conceptual test 1D	Quiz on Kinematics 1D, 2D, Dynamics, Circular Motion

	Conceptual test 2D Conceptual test Dynamics Conceptual test Circular Motion	
Lesson notes	Online quiz 1D Online quiz 2D Online quiz Dynamics Online quiz Circular Motion	Unit Lab (Circular Motion) video report and written report
Gizmo investigation	Lesson Problem Sets [Self-Check Answers] → Kinematics 1D → Kinematics 2D → Dynamics → Circular Motion	Unit Test End of Unit Teacher Student Conference and Observation

Unit 2:

AAL	AFL	AOL
Discussion Forum	Conceptual test Energy Conceptual test Momentum	Quiz on Energy and Momentum
Lesson notes	Online quiz Energy Online quiz Momentum	Unit Lab (elastic energy) video report and written report
Gizmo investigation	Lesson Problem Sets [Self-Check Answers] → Energy → Momentum	Unit Test End of Unit Teacher Student Conference and Observation

Unit 3:

AAL	AFL	AOL
------------	------------	------------

Discussion Forum	Conceptual test Electricity Conceptual test Magnetism	Quiz on Gravity, Electricity, and Magnetism
Lesson notes	Online quiz Gravitational Field Online quiz Electric Field Online quiz Magnetic Field	Unit Lab (Magnetic force) video report and written report
Gizmo investigation	Lesson Problem Sets [Self-Check Answers] → Electricity → Magnetism	Unit Test End of Unit Teacher Student Conference and Observation

Unit 4:

AAL	AFL	AOL
Discussion Forum	Conceptual test Optics	Quiz on Optics
Lesson notes	Online quiz Optics	Unit Lab (Double Slit) video report and written report
Gizmo investigation	Lesson Problem Sets [Self-Check Answers] → Optics (double slit, single slit, thin film interference)	Unit Test End of Unit Teacher Student Conference and Observation

Unit 5:

AAL	AFL	AOL
Discussion Forum	Conceptual test Relativity	Quiz on Modern Physics
Lesson notes	Online quiz Relativity	Unit Lab (Photoelectric Effect);

	Online quiz Quantum Mechanics	video report and written report
Gizmo investigation	Lesson Problem Sets [Self-Check Answers] → Relativity → Quantum Mechanics	Unit Project: Video presentation of photons polarization and quantum mechanics End of Unit Teacher Student Conference and Observation

Finals

AOL
Final Exam (6 complex problems with full solutions)

CONSIDERATION FOR PROGRAM PLANNING

PLANNING PROGRAMS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS

OES teachers are the key educators of students with special education needs and have a responsibility to help all students learn. Program planning for students with special education needs is guided by the principles set out in *Learning for All: A Guide to Effective Assessment and Instruction for All Students, Kindergarten to Grade 12 (2013)*: all students can succeed; each student has their own unique patterns of learning; successful instructional practices are founded on evidence-based research, tempered by experience; and universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students. Where a student has an Individual Education Plan (IEP), the accommodations identified in the IEP — instructional, environmental, and assessment — are implemented within the course, and the online learning environment is adapted accordingly. The asynchronous structure of OES courses provides built-in flexibility that supports many common accommodations, including extended time for assignments and assessments, breaks as needed, access to assistive technology, and the ability to review instructional material multiple times.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS

Ontario schools have some of the most linguistically diverse student populations in the world, and OES serves English language learners across Ontario and internationally. English language learners may be Canadian-born or newcomers; they may have experience of highly sophisticated educational systems or may have come from regions where access to formal schooling was limited. In planning this course, teachers consider the strengths and needs of English language learners and provide appropriate adaptations consistent with *English Language Learners / ESL and ELD Programs and Services: Policies and Procedures for Ontario Elementary and Secondary Schools, Kindergarten to Grade 12 (2007)*. Supports within the online environment include modification of instructional language without modification of curriculum expectations, use of visual and multimedia supports, opportunities to replay and review lesson content, extended time where appropriate, and teacher feedback that models academic English. Assessment

accommodations, such as granting additional time and permitting the use of bilingual dictionaries, are provided where appropriate.

ENVIRONMENTAL EDUCATION

Consistent with *Acting Today, Shaping Tomorrow: A Policy Framework for Environmental Education in Ontario Schools* (2009) and *Environmental Education: Scope and Sequence of Expectations* (2017), environmental education is embedded across the curriculum rather than treated as a separate subject. Teachers help students acquire knowledge about the environment, develop skills to address environmental issues, and foster attitudes that motivate responsible environmental action. As an online school, OES also models environmental responsibility through paperless course delivery and the elimination of daily commuting. Environmental education is a natural fit in this course: students investigate the relationships between science, technology, society, and the environment, including topics such as sustainability, resource use, and the environmental impact of human activity, consistent with the STSE focus of the Ontario science curriculum.

EQUITY AND INCLUSIVE EDUCATION

This course is planned and delivered in accordance with Ontario's Equity and Inclusive Education Strategy (2009) and Policy/Program Memorandum No. 119, *Developing and Implementing Equity and Inclusive Education Policies in Ontario Schools* (2013). OES is committed to an inclusive learning environment in which all students feel welcomed, respected, and able to succeed, regardless of ancestry, culture, ethnicity, sex, gender identity, sexual orientation, disability, race, religion, or socio-economic status. In this course, teachers select learning materials that reflect the diversity of Ontario and the wider world, address bias in texts and resources where it arises, and ensure that assessment practices are fair and free of cultural assumptions. Because OES students learn from communities across Ontario, Quebec, and around the world, discussion activities and teacher feedback are moderated to maintain a respectful, harassment-free environment for all learners.

FINANCIAL LITERACY EDUCATION

In accordance with *A Sound Investment: Financial Literacy Education in Ontario Schools* (2010) and current Ministry direction on financial literacy, students are provided with opportunities to build the knowledge and skills needed to make informed financial decisions, understand their roles as consumers and citizens, and think critically about the economic forces that affect their lives. OES also supports students in meeting the Ministry's financial literacy graduation requirement, as described in the OES School Course Calendar. In this course, students consider the economic dimensions of scientific and technological choices, including cost-benefit analysis of technologies and the financial implications of decisions that affect health and the environment.

FIRST NATIONS, MÉTIS, AND INUIT EDUCATION

Program planning in this course aligns with the Ontario First Nation, Métis, and Inuit Education Policy Framework (2007), which supports improved outcomes for First Nations, Métis, and Inuit students and promotes awareness and understanding of Indigenous histories, cultures, perspectives, and contributions among all students. Where appropriate to the curriculum expectations, teachers incorporate Indigenous perspectives, authors, and content, and approach these topics with accuracy and respect, drawing on Ministry-recommended resources. All OES students benefit from opportunities to deepen their knowledge of the histories and contemporary realities of First Nations, Métis, and Inuit peoples, including the legacy of the residential school system and the Truth and Reconciliation Commission's Calls to Action related to education.

THE ROLE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

Information and communications technology (ICT) is integral to every OES course: instruction, learning activities, assessment, and teacher-student communication all take place through the school's learning management system. ICT tools — including multimedia lessons, digital texts, simulations, video conferencing for proctored assessments, and word-processing and productivity software — extend and enrich instruction and allow students to collect, organize, and present their learning in a range of formats. Teachers help students develop digital citizenship skills, including responsible and ethical use of technology,

critical evaluation of online sources, protection of personal information, and academic integrity in digital environments, consistent with OES's Acceptable Use, Academic Honesty, and Artificial Intelligence policies as published in the School Course Calendar.

CAREER EDUCATION

Consistent with *Creating Pathways to Success: An Education and Career/Life Planning Program for Ontario Schools* (2013), teachers support students in answering the four questions at the centre of education and career/life planning: Who am I? What are my opportunities? Who do I want to become? What is my plan for achieving my goals? Expectations in this course include many opportunities for students to apply their skills to work-related situations, explore educational and career options, and become self-directed learners. OES guidance staff support students in course selection, postsecondary application planning (including OUAC, CEGEP, and international pathways), and the development of individual pathways plans. This course supports pathways into health sciences, engineering, environmental science, research, technology, and the skilled trades, and career connections within scientific fields are highlighted throughout the course.

COOPERATIVE EDUCATION AND OTHER FORMS OF EXPERIENTIAL LEARNING

Planned learning experiences in the community, including job shadowing, work experience, and cooperative education, provide students with opportunities to see the relevance of their classroom learning, explore careers of interest, and develop essential workplace skills consistent with *The Ontario Curriculum, Grades 11 and 12: Cooperative Education* (2018). Students may earn up to two cooperative education credits toward their compulsory credit requirements for the Ontario Secondary School Diploma. Students interested in experiential learning opportunities related to this course are encouraged to contact OES guidance staff to discuss options available to them.

HEALTH AND SAFETY

Although OES students learn remotely, health and safety remain integral considerations in program planning. Teachers model and promote safe and healthy practices for online learning, including sound ergonomics, balanced screen time, regular breaks, and strategies that support positive mental health and well-being. OES maintains a safe and respectful virtual learning environment consistent with the school's codes of conduct, bullying prevention expectations, and privacy practices as published in the School Course Calendar, and students are provided with clear channels for reporting concerns to their teachers, guidance staff, or the Principal. Where the course includes hands-on, at-home investigations, students receive explicit safety instruction, use only safe household materials as directed, and are required to follow all stated precautions; virtual labs and simulations are used where hands-on activity would pose a risk in a home setting.

ACCOMMODATIONS

Accommodations will be based on meeting with parent, teachers, administration and external educational assessment report. 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.
- ☐ **Environmental accommodations:** such as preferential seating or special lighting.
- ☐ **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.

- ☐ Record key words on the board or overhead when students are expected to make their own notes.
- ☐ 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.