Ontario eSecondary School
Course Outline
2024-2025

Ministry of Education Course Title: Physics, Grade 12, College Preparation	
Ministry Course Code: SPH4C	
Course Type: College Preparation	
Grade: 12	
Credit Value: 1.0	
Prerequisite(s): Science, Grade 10, Academic or Applied	
Department: Science	
Course developed by: **Laura Friberg**	**Date: January 15, 2021**
Length: **One Semester**	**Hours:** **110**
This course has been developed based on the following Ministry documents: 1. *The Ontario Curriculum, Grades 11 and 12 Science, Revised 2008* 2. *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)* 3. *Learning for All (2013)*	

COURSE DESCRIPTION/RATIONALE

This course develops students' understanding of the basic concepts of physics. Students will explore these concepts with respect to motion; mechanical, electrical, electromagnetic, energy transformation, hydraulic, and pneumatic systems; and the operation of commonly used tools and machines. They will develop their scientific investigation skills as they test laws of physics and solve both assigned problems and those emerging from their investigations. Students will also consider the impact of technological applications of physics on society and the environment.

OVERALL CURRICULUM EXPECTATIONS

Unit 1: Motion and Its Applications

- All motion involves a change in the position of an object over time.
- Motion can be described using mathematical relationships.
- Many technologies that utilize the principles of motion have societal and
- environmental implications.

Unit 2: Mechanical Systems

- Mechanical systems use force to do work.
- The operation of mechanical systems can be described using mathematical relationships.
- Friction is a force that influences the design, use, and effectiveness of mechanical systems.
- Mechanical systems can be used to address social and environmental challenges.

Unit 3: Electricity and Magnetism

- Relationships between electricity and magnetism are predictable.
- Electricity and magnetism have many technological applications.
- Technological applications that use electricity and magnetism can affect society and
- the environment in positive and negative ways.

Unit 4: Energy Transformations

- Energy can be transformed from one type to another.
- Systems that involve energy transformations are never 100% efficient.
- Although technological applications that involve energy transformations can affect
- society and the environment in positive ways, they can also have negative effects, and
- therefore must be used responsibly.

Unit 5: Hydraulic and Pneumatic Systems

- Fluids under pressure can be used to do work.
- Fluids under pressure have predictable properties and many technological applications.
- The uses of hydraulic and pneumatic systems can have social and economic consequences.

COURSE CONTENT

Unit	*Length*
Unit 1: Motion and Its Applications	30 hours
Unit 2: Mechanical Systems	19 hours
Unit 3: Electricity and Magnetism	27 hours
Unit 4: Energy Transformation	13 hours
Unit 5: Hydraulic and Pneumatic Systems	16 hours
Unit 6: Exam and Review Assignments	5 hours
Total	**110 Hours**

UNIT DESCRIPTIONS

Unit 1 - Motion and Its Applications
Students will analyse selected technologies that are used to move objects or track their motion, and evaluate their impact on society and the environment, including their contribution to scientific knowledge. They will investigate, in qualitative and quantitative terms, the linear uniform and non-uniform motion of objects, and solve related problems. In addition, they will demonstrate an understanding of different kinds of motion and the relationships between speed, acceleration, displacement, and distance.

Unit 2 - Mechanical Systems
Students will analyse common mechanical systems that use friction and applied forces, and evaluate their effectiveness in meeting social or environmental challenges. They will investigate forces, torque, work, coefficients of friction, simple machines, and mechanical advantage, and interpret related data. They will demonstrate an understanding of concepts related to forces and mechanical advantage in relation to mechanical systems.

Unit 3 - Electricity and Magnetism
Students will analyse the development of selected electrical and electromagnetic technologies, and evaluate their impact on society and the environment. They will investigate real and simulated mixed direct current circuits and the nature of magnetism and electromagnetism, and analyse related data. They will demonstrate an understanding of the basic principles of electricity and magnetism.

Unit 4 - Energy Transformation
Students will evaluate the impact on society and the environment of energy-transformation technologies, and propose ways to improve the sustainability of one such technology. They will investigate energy transformations and the law of conservation of energy, and solve related problems. They will demonstrate an understanding of diverse forms of energy, energy transformations, and efficiency

Unit 5 - Hydraulic and Pneumatic Systems

Students will analyse the development of technological applications related to hydraulic and pneumatic systems, and assess some of the social and environmental effects of these systems. They will investigate fluid statics, fluid dynamics, and simple hydraulic and pneumatic systems. They will demonstrate an understanding of the scientific principles related to fluid statics, fluid dynamics, and hydraulic and pneumatic systems.

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.

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.

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.

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.

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.

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
- ❑ Diagnostic tests and writing tasks
- ❑ Reflections
- ❑ Oral presentations & Active Listening
- ❑ Tests & Exam
- ❑ Evaluations

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 or towards the end of the course. This evaluation will be based on evidence from one or a combination of the following: an examination, a performance, and/or another method of evaluation suitable to the course content. The final evaluation allows the student an opportunity 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
Course Work	**70**
Knowledge/Understanding (K)	20
Thinking/Inquiry (T)	15
Communication (C)	15
Application (A)	20
Final	**30**
Exam (7.5K, 7.5T, 7.5C, 7.5A)	30

TERM WORK EVALUATIONS (70%)

Evaluation Item	Description	Category	Weight
Unit 1 Lab Assignment	Students will apply unit concepts in interactive lab activities.	K, T, C, A	18
Unit 1 Instantaneous Velocity	Research-based projects for each unit based on applications of learned functions to real life problems	K, T, C, A	
Unit 1 Test	Unit tests are based on curriculum expectations and cover the entirety of each unit	K, T, C, A	
Unit 2 Project	Research-based projects for each unit based on applications of learned functions to real life problems	K, T, C, A	17
Unit 2 Activity	Research-based projects for each unit based on applications of learned functions to real life problems	K, T, C, A	
Unit 2 Test	Unit tests are based on curriculum expectations and cover the entirety of each unit	K, T, C, A	
Unit 3 Combination Circuits	Problem sets supplement lessons and are used to assess whether or not students are meeting criteria for success	K, T, C, A	14
Unit 3 Test	Unit tests are based on curriculum expectations and cover the entirety of each unit	K, T, C, A	
Unit 4 STSE	Live interviews are used to evaluate students through observation and conversation. Some of these are a part of other research projects.	K, T, C, A	9
Unit 4 Test	Unit tests are based on curriculum expectations and cover the entirety of each unit	K, T, C, A	
Unit 5 Pressure	Research-based projects for each unit based on applications of learned functions to real life problems	K, T, C, A	12
Unit 5 Test	Unit tests are based on curriculum expectations and cover the entirety of each unit	K, T, C, A	

FINAL EVALUATIONS (30%)

Evaluation Item	Description	Category	Weight
Final Exam	A final, written examination, covering all curriculum expectations for the course.	K, T, C, A	30

AFL/AAL/AOL Tracking Sheet:

Unit 1:

AAL	**AFL**	**AOL**
1.1.1 Measurement and Significant Digits	1.1.2 Measurements and Significant Digits Practice	1.5.3 Speed-Time Graphs for Acceleration Gizmo

1.2.1 Scientific Notation and Factor Label Method	1.2.2 Scientific Notation and Factor Label Method Practice	1.6.2 Instantaneous Speed (AOL)
1.3.1 Relating Speed to Distance and Time	1.3.3 Relating Speed to Distance and Time Gizmo Activity	Unit 1 Test
1.3.2 Relating Speed to Distance and Time Practice	1.5.3 Speed-Time Graphs for Acceleration Gizmo	
1.4.1 Defining Acceleration	Unit 1 Self Assessment	
1.4.2 Acceleration Practice (AAL)	Unit 1 Conference	
1.5.1 Speed-Time Graphs for Acceleration		
1.5.2 Speed-Time Graphs for Acceleration Practice		
1.6.1 Instantaneous Speed		
1.7.1 Vectors - Position and Displacement		
1.7.2 Vectors - Position and Displacement (AAL)		
1.8.1 Acceleration and Velocity		
1.8.2 Acceleration and Velocity (AAL)		
1.9.1 Forces and Free Body Diagrams		
1.9.2 Forces and Free Body Diagrams (AAL)		
1.10.1 Newton’s First Law		
1.10.2 Newton’s First Law (AAL)		
1.11 Newton’s Second Law of Motion		
1.11 Newton’s Second Law of Motion (AAL)		
Unit 1 Review		

Unit 2:

AAL	AFL	AOL
2.1.1 Friction and Coefficients of Friction	2.4.3 Levers Gizmo (AFL)	2.2.2 Friction (AOL)
2.1.2 Friction and Coefficients of Friction (AAL)	2.6.2 Domestic and Industrial Machines (AFL)	2.4.3 Levers Gizmo (AFL)
2.2.1 Controlling Friction	2.8.2 Unit 2 Self Evaluation	2.7.1 STSE Project
2.3.1 Simple Machines	2.8.3 Unit 2 Conference	2.8.4 Unit 2 Test
2.3.2 Simple Machines (AAL)		
2.4.1 Torque and Levers		
2.4.2 Torque and Levers (AAL)		
2.5.1 Mechanical Advantage and Efficiency		
2.5.2 Mechanical Advantage and Efficiency (AAL)		
2.6.1 Domestic and Industrial Machines		
2.8.1 Unit 2 Review		

Unit 3:

AAL	AFL	AOL
3.1.1 Electrostatics	3.4.2 Electrical Potential Difference (AFL)	3.7.2 Combination Circuits (AOL)
3.1.2 Electrostatics (AAL)	3.6.2 Kirchhoff's Law gizmo	3.11.4 Unit 3 Test
3.2.1 Electric Fields and Electric Charge	3.9.2 Magnetic Force Fields and Oersted's Principle (AFL)	
3.2.2 Electric Fields and Electric Charge (AAL)	3.10.2 Electric Motors (AFL)	
3.3.1 Electric Current	3.11.1 Unit 3 Review (AFL)	
3.3.2 Electric Current (AAL)		

3.3.2 Labeling Circuits (AAL) questions and answers		
3.4.1 Electrical Potential Difference		
3.5.1 Ohm's Law		
3.5.2 Ohm's Law (AAL)		
3.6.1 Kirchhoff's Law for Electrical Circuits		
3.7.1 Combination Circuits		
3.8.1 Power and Energy		
3.8.2 Power and Energy (AAL)		
3.9.1 Magnetic Force Fields and Oersteds Principle		
3.11.2 Student Self-Evaluation		

Unit 4:

AAL	**AFL**	**AOL**
4.1.1 Energy Forms and Transformations	4.1.3 Energy Transformations Gizmo (AFL)	4.3.2 Thermal Energy and Heat Conservation Energy (AOL)
4.1.2 Energy Forms and Transformations (AAL)	4.4.2 Energy Resources (AFL)	4.5.1 STSE Project
4.2.1 Gravitational and Potential Energy and Kinetic Energy	4.5.2 Self Evaluation	4.5.4 Unit 4 Test
4.2.2 Gravitational and Potential Energy and Kinetic Energy (AAL)	4.5.3 Unit 4 Conference	
4.3.1 Thermal Energy and Heat Conservation Energy		
4.4.1 Energy Resources		

Unit 5:

AAL	**AFL**	**AOL**
5.1.1 Properties of Fluids	5.4.2 Fluid Systems (AFL)	5.2.2 Pressure (AOL)

5.1.2 Properties of Fluids (AAL)	5.6.1 Self Evaluation	5.5.4 Unit 5 Test
5.2.1 Pressure	5.5.3 Unit 5 Conference	
5.3.1 Pascal's Principle		
5.3.2 Pascal's Principle (AAL)		
5.4.1 Fluid Systems		
5.5.1 Fluid Dynamics		
5.5.2 Fluid Dynamics		
5.6.2 Unit 5 Review		

Unit 6: Course Review and Final Exam

AAL	AFL	AOL
	6.1.1 Review Assignment (AFL)	Final Exam (AOL)

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.