INUKSHUK ACADEMY

Course code: **Physics (SPH3U)**
Total Hours: **110 hours** and Credit: **1.0**
Prerequisite: **Science, Grade 10, Academic**
Curriculum basis: **Ontario Curriculum, Grades 11–12: Science (Revised 2008)**
Last Update: **Inukshuk Academy May 2026**

Table of Contents

Course Description

This course develops students' understanding of the basic concepts of physics. Students will explore kinematics, with an emphasis on linear motion; different kinds of forces; energy transformations; the properties of mechanical waves and sound; and electricity and magnetism. They will enhance their scientific investigation skills as they test laws of physics. In addition, they will analyse the interrelationships between physics and technology, and consider the impact of technological applications of physics on society and the environment.

1. Course Rationale

Physics provides the scientific and mathematical foundation for understanding motion, forces, energy, waves, electricity, and magnetism in the natural and technological world. SPH3U introduces students to the basic concepts of physics and strengthens their ability to investigate physical systems, solve problems, and explain relationships using evidence. Through inquiry, experimentation, and modelling, students:

- Develop an understanding of linear motion, forces, energy transformations, waves, sound, electricity, and magnetism;
- Apply scientific investigation skills to test laws and principles of physics;
  Use mathematical models, graphs, diagrams, and equations to describe and analyze physical phenomena;
- Learn to collect, interpret, and communicate data from laboratory and simulation-based investigations;
- Examine how physics-based technologies affect society, the environment, and everyday life.

The course fosters scientific literacy, problem-solving, critical thinking, and technological awareness, preparing students for senior physics courses, university pathways, and future studies or careers in science, engineering, health sciences, and technology.

2. Overall Curriculum Expectations

The Ontario Curriculum organizes SPH3U into five major strands. The following expectations are paraphrased for clarity and alignment with Inukshuk Academy's course design.

a. Scientific Investigation Skills and Career Exploration

Students will:

- Demonstrate scientific investigation skills in inquiry and research, including planning, performing, recording, analyzing, interpreting, and communicating;
- Use appropriate scientific terminology, units, graphs, diagrams, and mathematical models;
- Identify careers related to physics and describe contributions of scientists, including Canadians.

b. Kinematics

Students will:

- Analyze technologies that apply concepts related to motion and assess their social and environmental impact;
- Investigate uniform and non-uniform linear motion qualitatively and quantitatively; Demonstrate an understanding of motion in one and two dimensions.

c. Forces

Students will:

- Analyze technologies that apply Newton's laws and propose improvements;
- Investigate relationships among net force, mass, and acceleration;
- Demonstrate an understanding of how unbalanced forces cause changes in motion.

d. Energy and Society

Students will:

- Analyze technologies involving energy transformations and assess their social and environmental impact;
- Investigate conservation of energy and solve related problems;
- Demonstrate an understanding of work, efficiency, power, kinetic energy, gravitational potential energy, nuclear energy, and thermal energy transfer.

e. Waves and Sound

Students will:

- Analyze how mechanical waves and sound affect technology, structures, society, and the environment;
- Investigate wave properties qualitatively and quantitatively;
- Demonstrate an understanding of the production, transmission, interaction, and reception of mechanical waves and sound.

f. Electricity and Magnetism

Students will:

- Analyze the social, economic, and environmental impact of electrical energy production and electromagnetism-related technologies;
- Investigate magnetic fields and electric circuits qualitatively and quantitatively;
- Demonstrate an understanding of magnetic fields, current and electron flow, and technologies that produce and transmit electrical energy.

3. Learning Goals for Students

By the end of SPH3U, students will be able to:

- Analyze motion, forces, energy, waves, electricity, and magnetism using scientific models and mathematical relationships;
- Conduct investigations using appropriate experimental design, observation, measurement, and data analysis skills;
- Solve qualitative and quantitative problems involving kinematics, Newton's laws, energy transformations, wave behaviour, circuits, and magnetic fields;
- Interpret physical data using graphs, equations, diagrams, scientific notation, and SI units;
- Evaluate the impact of physics-related technologies on society, the economy, and the environment;
- Communicate scientific reasoning clearly using appropriate physics terminology, diagrams, calculations, and units.

Course Structure and Instructional Units

Unit	Description	Hours
Unit 0: Scientific Skills and Measurement	Scientific investigation skills, lab safety, measurement, significant digits, graphing, unit conversion	**5 hours**
Unit 1: Kinematics	Linear motion, vectors, displacement, velocity, acceleration, projectile motion	**22 hours**
Unit 2: Forces	Newton's laws, net force, friction, free-body diagrams, dynamics applications	**22 hours**
Unit 3: Energy and Society	Work, energy, power, efficiency, conservation of energy, thermal and nuclear energy	**21 hours**
Unit 4: Waves and Sound	Mechanical waves, sound energy, resonance, wave interactions, wave applications	**21 hours**
Unit 5: Electricity and Magnetism	Electric circuits, current, voltage, resistance, magnetic fields, electromagnetism	**16 hours**
Culminating Task	Inquiry investigation, applied physics project, or performance task	**2 hours**
Final Exam	Proctored final examination	**1 hour**
	Total	**110 hours**

4. Course Structure, Unit Overview and Instructional Plan

1. Unit 0: Scientific Skills and Measurement

Approx. Hours: 5

a. Unit Overview

This introductory unit strengthens the foundational scientific skills students need for Grade 11 physics investigations. Students review measurement, significant digits, scientific notation, SI units, unit conversions, graphing, and basic data analysis. They learn how to collect observations, organize data, identify patterns, and communicate results clearly.

Students also develop safe and effective laboratory habits and begin applying inquiry skills such as forming questions, making predictions, identifying variables, recording evidence, and drawing conclusions. These skills support learning throughout the course and are integrated into all SPH3U units.

b. Key Learning Goals

Students will:

- Apply rules for significant digits, scientific notation, and SI units in physics calculations;
- Use unit analysis to check formulas and verify solutions;
- Collect, organize, and interpret experimental data accurately;
- Identify common sources of measurement error and describe their effect on results;
- Communicate observations, calculations, graphs, and conclusions clearly.

c. Sample Learning and Assessment Activities

- Diagnostic math and physics skills review;
- Measurement and graphing lab using basic physics equipment or simulations;
- Unit conversion and scientific notation practice problems;
- Graphing motion data and interpreting slope;
- Short inquiry task focused on variables, observations, and conclusions.

2. Unit 1: Kinematics

Approx. Hours: 22

a. Unit Overview

In this unit, students develop an understanding of motion in one and two dimensions, with an emphasis on linear motion. Students examine displacement, velocity, acceleration, scalar and vector quantities, motion graphs, and equations of motion. They learn to describe and analyze uniform and non-uniform motion using words, diagrams, graphs, and mathematical models.

Students also explore projectile motion as an application of two-dimensional motion. Real-world technologies such as traffic monitoring systems, vehicle safety systems, GPS tracking, and sports motion analysis provide context for examining how kinematics concepts are used in society and technology.

b. Key Learning Goals

Students will:

- Describe uniform and non-uniform motion using appropriate terminology;
- Analyze position-time, velocity-time, and acceleration-time graphs;
- Solve problems involving displacement, velocity, acceleration, and time;

- Apply vector concepts to motion in one and two dimensions;
- Investigate motion using observations, measurements, simulations, or video analysis;
- Assess technologies that apply kinematics concepts.

c. Sample Learning and Assessment Activities

- Motion graphing and interpretation tasks;
- Vector and displacement problem sets;
- Constant acceleration investigation using carts, ramps, or simulations;
- Projectile motion analysis using video or virtual labs;
- Case study on GPS, speed cameras, or vehicle motion technologies;
- Lab report, quizzes, quantitative problem sets, and unit test.

3. Unit 2: Forces

Approx. Hours: 22

a. Unit Overview

In this unit, students investigate the relationship between forces and motion using Newton's laws of motion. Students learn to identify and analyze forces acting on objects, including gravitational force, normal force, friction, tension, and applied force. Free-body diagrams and algebraic problem solving are used to explain how unbalanced forces affect acceleration and changes in motion.

Students explore real-world applications of dynamics through technologies such as vehicle safety systems, amusement park rides, transportation systems, and sports equipment. Laboratory investigations and simulations help students develop an understanding of how forces interact in everyday situations and technological systems.

b. Key Learning Goals

Students will:

- Apply Newton's laws of motion to explain changes in velocity and acceleration;
- Construct and interpret free-body diagrams;
- Solve problems involving net force, mass, acceleration, and friction;
- Investigate the relationship between balanced and unbalanced forces;
- Analyze technologies that use principles of dynamics and evaluate their impact on society and the environment;
- Conduct experiments to measure and analyze forces and motion.

c. Sample Learning and Assessment Activities

- Free-body diagram and force analysis activities;
- Friction and acceleration investigations using carts or simulations;
- Newton's laws experiments and motion sensor labs;

- Case studies involving airbags, seat belts, roller coasters, or vehicle braking systems;
- Quantitative problem sets, laboratory reports, quizzes, and unit test.

4. Unit 3: Energy and Society

Approx. Hours: 21

a. Unit Overview

In this unit, students explore energy transformations and the law of conservation of energy. Students investigate work, power, efficiency, kinetic energy, gravitational potential energy, thermal energy, heat transfer, and nuclear energy. They use mathematical models to solve problems involving energy changes in physical systems.

Students also examine how energy technologies affect society and the environment. Topics may include renewable and non-renewable energy sources, nuclear power, energy efficiency, transportation, heating and cooling systems, and sustainable energy use.

b. Key Learning Goals

Students will:

- Explain work, power, efficiency, kinetic energy, gravitational potential energy, thermal energy, and nuclear energy;
- Apply the law of conservation of energy to solve problems;
- Investigate energy transformations using experiments or simulations;
- Analyze energy efficiency and energy loss in real systems;
- Evaluate the social, economic, and environmental impacts of energy technologies.
- Evaluate technologies based on field interactions (e.g., MRI machines, magnetic levitation).

c. Sample Learning and Assessment Activities

- Work, energy, and power problem sets;
- Energy conservation investigation using carts, ramps, or simulations;
- Thermal energy and heat transfer activities;
- Research task on nuclear energy or renewable energy technologies;
- Lab report, energy analysis assignment, quizzes, and unit test.

5. Unit 4: Waves and Sound

Approx. Hours: 21

a. Unit Overview

In this unit, students investigate the properties of mechanical waves and sound. Students examine wave characteristics such as amplitude, wavelength, frequency, period, speed, reflection, interference, resonance, and the Doppler effect. They use diagrams, equations, simulations, and investigations to describe how waves are produced, transmitted, and received.

Students also explore how waves and sound affect technology, structures, society, and the environment. Applications may include musical instruments, noise reduction, ultrasound, communication systems, building design, and hearing protection.

b. Key Learning Goals

Students will:

- Describe the properties and behaviour of mechanical waves and sound;
- Solve problems involving wave speed, frequency, wavelength, and period;
- Investigate reflection, interference, resonance, and the Doppler effect;
- Explain how sound is produced, transmitted, and detected;
- Evaluate technologies and strategies that use or reduce the effects of waves and sound.

c. Sample Learning and Assessment Activities

- Wave characteristics investigation using springs, simulations, or ripple tanks;
- Sound frequency and resonance lab;
- Doppler effect and interference simulations;
- Case study on noise pollution, ultrasound, musical instruments, or soundproofing;
- Wave problem sets, lab reports, quizzes, and unit test.

6. Unit 5: Electricity and Magnetism

Approx. Hours: 21

a. Unit Overview

In this unit, students investigate electric circuits, magnetic fields, and the relationship between electricity and magnetism. Students examine current, voltage, resistance, series and parallel circuits, Ohm's law, electric power, magnetic fields, electromagnets, motors, generators, and electromagnetic induction.

Students explore how electrical and electromagnetic technologies are used to produce, transmit, and use electrical energy. They also assess the social, economic, and environmental impacts of electrical energy production and electromagnetism-based technologies.

b. Key Learning Goals

Students will:

- Describe current, voltage, resistance, electric power, and circuit behaviour;
- Analyze series and parallel circuits using Ohm's law and circuit diagrams;
- Investigate magnetic fields and the relationship between electricity and magnetism;
- Explain the operation of electromagnets, motors, generators, and transformers;
- Evaluate the sustainability and impact of electrical energy technologies.

c. Sample Learning and Assessment Activities

- Circuit-building investigations using equipment or simulations;
- Ohm's law and electric power problem sets;
- Magnetic field mapping using compasses or simulations;
- Motor, generator, or electromagnet design activity;
- Case study on electrical energy production, transmission, or sustainability;
- Lab reports, circuit analysis tasks, quizzes, and unit test.

Instructional Approaches

Teaching and learning in SPH3U at Inukshuk Academy incorporate a variety of instructional strategies designed to help students develop conceptual understanding, scientific inquiry skills, mathematical reasoning, and confidence in applying physics to real-world situations. Instruction is guided by the principles of inquiry-based learning, experimentation, problem solving, and the scientific processes outlined in the Ontario Curriculum.

a. Inquiry-Based and Experiential Learning

Students learn physics most effectively through active investigation and exploration. Lessons regularly include hands-on activities, experiments, simulations, modelling tasks, and inquiry-based investigations that reinforce major physics concepts.

Examples include:

- Investigating motion using carts, ramps, or motion sensors;
- Conducting experiments related to Newton's laws and friction;
- Exploring energy transformations through lab activities and simulations;
- Investigating wave behaviour, sound, circuits, and electromagnetism using practical activities and virtual labs.

b. Multiple Representations of Concepts

Students explore physics concepts through a combination of:

- Mathematical equations and calculations;
- Graphs, diagrams, and free-body diagrams;
- Written explanations and scientific discussions;
- Simulations and visual demonstrations;
- Laboratory investigations and physical models.

Using multiple representations helps students build stronger conceptual understanding and connect mathematical relationships to observable phenomena.

c. Use of Technology and Digital Tools

Digital tools are integrated throughout the course to support inquiry, visualization, and data analysis. Technology may be used to:

- Collect and analyze motion and energy data;
- Create and interpret graphs;
- Simulate wave motion, circuits, and magnetic fields;
- Model physical systems and energy transformations;
- Support scientific research and collaborative learning.

Examples include PhET simulations, graphing software, virtual labs, Desmos, GeoGebra, and online data analysis tools.

d. Collaborative Problem Solving

Students are encouraged to work collaboratively to strengthen communication and scientific reasoning skills. Students may work in pairs or groups to:

- Solve quantitative and conceptual physics problems;
- Conduct investigations and laboratory activities;
- Discuss observations and compare solution strategies;
- Present and critique scientific explanations.

Collaborative learning supports deeper understanding and encourages active participation in scientific inquiry.

e. Differentiated Instruction

Instruction is adapted to support a range of learning styles, interests, readiness levels, and learning needs. Strategies may include:

- Scaffolded problem-solving activities with gradual increases in complexity;

- Visual supports, graphic organizers, and guided notes;
- Enrichment opportunities for advanced learners;
- Alternative methods of demonstrating understanding;
- Additional support and review opportunities where needed.

f. Explicit Teaching of Scientific Inquiry Skills

Students receive direct instruction and practice in scientific investigation skills throughout the course, including:

- Formulating hypotheses and predictions;
- Identifying variables and designing investigations;
- Collecting, organizing, and analyzing data;
- Constructing graphs and interpreting trends;
- Identifying sources of error and uncertainty;
- Drawing conclusions supported by evidence and communicating findings clearly.

Assessment and Evaluation

Assessment in SPH3U aligns with the principles outlined in *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010).* Evaluation reflects students' most consistent level of achievement throughout the course, with special consideration given to more recent evidence of learning.

Assessment serves three main purposes:

a. Assessment for Learning (Diagnostic)

Diagnostic assessment is used at the beginning of learning to identify students' prior knowledge, strengths, and areas requiring support.

Examples include:

- Initial math and physics skills review;
- Diagnostic quizzes and concept checks;
- Classroom discussions and informal observations;
- Pre-lab discussions and prediction activities.

b. Assessment as Learning (Formative)

Formative assessment helps students monitor their own progress, reflect on learning, and improve their understanding through feedback and revision.

Examples include:

- Homework and practice problem sets;

- Laboratory activities and guided investigations;
- Self-assessment and reflection tasks;
- Draft submissions and peer feedback activities;
- Interactive simulations and inquiry exercises.

c. Assessment of Learning (Summative)

Summative assessment evaluates student achievement of curriculum expectations at the end of a learning cycle or unit.

Examples include:

- Unit tests and quizzes;
- Laboratory reports and inquiry investigations;
- Research assignments, Presentations and case studies;
- Applied physics problem-solving tasks;
- Culminating performance task;
- Final examination.

d. Achievement Chart Categories

Student achievement is evaluated according to the four categories outlined in the Ontario Curriculum for Science:

Knowledge & Understanding (30%)
Demonstration of understanding of physics concepts, theories, formulas, terminology, and scientific principles related to motion, forces, energy, waves, electricity, and magnetism.

Thinking & Inquiry (20%)
Use of critical thinking, scientific inquiry, problem solving, data analysis, experimentation, and investigation skills.

Communication (20%)
Communication of scientific ideas and reasoning using appropriate terminology, diagrams, graphs, calculations, units, and written explanations.

Application (30%)
Application of physics concepts and skills to real-world situations, technological systems, laboratory investigations, and interdisciplinary contexts.

e. Final Evaluation (30 percent)

The final evaluation consists of:

1. Culminating Performance Task (10–15%)

Students complete an applied investigation, inquiry task, research assignment, or physics-based project that integrates knowledge and skills from multiple course strands.

Examples may include:

• Investigating energy efficiency in a physical system;
• Designing and analyzing a simple electric circuit or electromagnet;
• Conducting a motion or forces investigation;
• Researching the impact of a physics-related technology on society and the environment.

2. Final Examination (15–20%)

A proctored final exam assesses students' conceptual understanding, mathematical problem solving, scientific inquiry skills, and ability to apply physics principles across all course units.

3. Summary of Achievement Levels and Percentage Grade Ranges

Student achievement in secondary school courses is evaluated according to the Ontario Ministry of Education's four-level achievement scale. Each percentage grade corresponds to a level of achievement as outlined below:

Percentage Grade Range	Achievement Level	Summary Description
80–100%	Level 4	Demonstrates a very high to outstanding level of achievement. Performance exceeds the provincial standard.
70–79%	Level 3	Demonstrates a high level of achievement. Performance meets the provincial standard.
60–69%	Level 2	Demonstrates a moderate level of achievement. Performance is below but approaching the provincial standard.
50–59%	Level 1	Demonstrates a passable level of achievement. Performance is significantly below the provincial standard.
Below 50%	Level 0	Insufficient achievement of curriculum expectations. A credit will not be granted.

Academic Honesty and Integrity Policy

Inukshuk Academy is committed to fostering a learning environment based on honesty, responsibility, respect, and academic integrity. Students are expected to submit original work and properly acknowledge all sources of information, ideas, images, data, and wording used in assignments and investigations. Academic honesty is essential to maintaining fairness and trust in the evaluation process.

All submitted work must represent the student's own understanding and effort. Sources must be documented appropriately using MLA or APA citation style, as directed by the teacher. The use of generative artificial intelligence tools (e.g., ChatGPT) or other forms of external assistance must be disclosed and approved by the teacher. Undisclosed or inappropriate use of such tools may be treated as academic dishonesty.

Students may be asked to provide process work, rough drafts, notes, calculations, or planning documents to verify authorship and learning progress. If academic dishonesty occurs, the student and Principal may be notified, and consequences will be applied in accordance with school policy. Repeated incidents may result in escalating consequences.

1. Improper Citation

Improper citation occurs when a student fails to use appropriate citation formatting when referencing sources.

Grade Level	First Instance	Subsequent Instances
Grades 9–10	Warning and opportunity to resubmit	Warning and opportunity to resubmit
Grades 11–12	Warning and opportunity to resubmit	Opportunity to resubmit, maximum grade of 75%

2. Unaccredited Paraphrasing

Unaccredited paraphrasing occurs when a student rewrites another person's ideas without giving proper credit.

Grade Level	First Instance	Subsequent Instances
Grades 9–10	Warning and resubmission allowed	Resubmission allowed, maximum grade of 75%
Grades 11–12	Resubmission allowed, maximum grade of 75%	Resubmission allowed, maximum grade of 50%

3. Unaccredited Verbatim Copying

This occurs when a student copies sentences or passages directly from a source without proper citation.

Grade Level	First Instance	Subsequent Instances
Grades 9–10	Resubmission allowed, maximum grade of 75%	Resubmission allowed, maximum grade of 50%
Grades 11–12	Resubmission allowed, maximum grade of 50%	Grade of zero. No resubmission permitted

4. Full Plagiarism

Full plagiarism occurs when a student submits work entirely created by another person or source.

Grade Level	First Instance	Subsequent Instances
Grades 9–10	Grade of zero. No resubmission	Grade of zero. No resubmission
Grades 11–12	Grade of zero. No resubmission	Grade of zero and possible removal from the course

5. Missed Work

Students are responsible for reviewing lesson materials, completing missed assignments, and meeting established deadlines. Students are expected to remain informed about course expectations, due dates, and assessment requirements.

6. Homework Expectations

Students are expected to:

- Complete homework assignments, readings, and practice problems on time;
- Prepare for scheduled lessons, laboratories, discussions, and assessments;
- Participate actively and consistently in course activities and investigations.

If homework is repeatedly incomplete, the teacher may:

- Schedule a meeting with the student;
- Contact parents or guardians;
- Consult with school administration to support student success and progress.

Inclusion, accommodations & ELL supports

Inukshuk Academy is a small private school with limited accommodation resources. The school is committed to supporting students' access to learning within the scope of available staffing, programming, facilities, and course delivery structures.

Where possible, reasonable accommodations may be provided for students with documented learning needs, including limited support for Individual Education Plans (IEPs). Accommodations are considered on a case-by-case basis in consultation with the student, parents/guardians, teacher, and school administration.

Possible supports may include:

- Clear written instructions and success criteria;
- Guided notes, visual examples, and scaffolded practice;
- Reasonable extended time where appropriate;

- Preferential seating or reduced-distraction work space when available;
- Use of approved assistive technology;
- Check-ins with the teacher to support organization and progress;
- ELL support through simplified instructions, vocabulary support, and additional clarification.

Inukshuk Academy may not be able to provide specialized programming, intensive one-on-one support, modified curriculum expectations, or accommodations requiring resources beyond the school's capacity. Students requiring significant accommodations or specialized services may need additional external support.

Instructional Philosophy

Teaching and learning in SPH3U emphasize:

- Inquiry-based learning through investigations, labs, and simulations;
- Conceptual understanding of motion, forces, energy, waves, electricity, and magnetism;
- Mathematical modelling of basic physics relationships;
- Multiple representations, including equations, graphs, diagrams, free-body diagrams, and demonstrations;
- Real-world applications of physics in technology, society, and the environment;
- Collaboration through discussions, problem-solving activities, and group investigations;
- Technology integration for simulations, graphing, data collection, and analysis.

This approach helps students build a strong foundation in physics while developing problem-solving, scientific reasoning, and transferable STEM skills.

Course Learning Resources

Students will engage with a variety of physics learning materials, both digital and print, selected to support inquiry, experimentation, and conceptual development.

a. Primary Resources

- Teacher-created notes, examples, and practice sets
- Physics demonstrations and simulation tools
- Laboratory equipment (sensors, timers, optical equipment)
- *Ontario Curriculum, Grades 11–12: Science (2008)* [1]

b. Digital Tools and Platforms

- PhET Interactive Simulations (fields, waves, quantum effects)
- Pasco/Vernier data acquisition software
- Desmos or GeoGebra for graphing and modelling
- Video analysis tools (e.g., Tracker)

c. Supplementary Resources

- Scientific journals, articles, and multimedia related to physics innovations
- Problem banks and practice exams
- Real-world case studies on physics applications

References

[1] Ministry of Education, "Course Descriptions and Prerequisites," August 2024. [Online]. Available: https://www.dcp.edu.gov.on.ca/en/course-descriptions-and-prerequisites.

[2] Ministry of Education, "Ontario Secondary School Diploma (OSSD) Grade (9-12)," [Online]. Available: https://www.dcp.edu.gov.on.ca/en/.

[3] Ministry of Education, "Growing Sucess," 2010. [Online]. Available: https://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf.