# Physics 12

*Foundational Outcomes*

NOVA SCOTIA
NOUVELLE-ÉCOSSE

2021

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Prepared by the Department of Education and Early Childhood Development

This is the most recent version of the current curriculum materials as used by teachers in Nova Scotia.

# Physics 12

**EECD has made suggestions for prioritizing outcomes to assist teachers as they support student learning. Teachers will need to make their professional decisions based on the needs of their students.**

The Foundational Outcomes identified in this document represent outcomes determined to be relevant for future learning in the discipline. Decisions about foundational outcomes were made in consultation with teachers, science specialists and post-secondary institution expectations. The foundational outcomes are meant to guide teachers in making decisions about creating learning experiences that will prepare and engage their learners in a responsive way. However, a teacher's professional judgment remains the most crucial factor for responding effectively to the needs of learners.

It might be relevant for teachers to review or to seek out learning outcomes from an earlier curriculum or grade level in order to support learners moving forward with current curriculum. Sometimes, however, current curricular learnings do not directly rely on learning from the previous year and current curriculum can be engaged in without additional review.

The learning environment (face-to-face, blended, online) will continue to be an important factor that will impact the types of learning experiences with which learners are able to engage. While learning science in a hands-on, experimental way is preferred, should laboratory experiments not be possible due to public health concerns, teachers are encouraged to offer online experiment simulations, to record scientific phenomena to discuss, notice, observe and unpack with learners, to support simple, safe experiments that could be done at home, to provide authentic data that can be analysed etc…

Integrated, project-based learning and inquiry-based learning (especially in areas that connect STSE) allow for learner choice and flexible pacing which is particularly effective for students to not only learn new concepts but also for demonstrating their learning.

It is suggested that the focus for science in grades 9-12 be on using the foundational outcomes to focus on foundational understandings for future learning, encouraging cross-cutting scientific themes and application of learning. Weighting for course modules should be reflective of the amount of time spent exploring the outcomes in the module.

## Unit: Force, Motion, Work, and Energy

<u>Subtopic: DYNAMICS EXTENSION</u>

- use vector analysis in two dimensions for systems involving two or more masses, relative motions, static equilibrium, and static torques (ACP-1)

<u>Subtopic: COLLISIONS IN TWO DIMENSIONS</u>

- apply quantitatively the laws of conservation of momentum to two-dimensional collisions and explosions (326-3)

<u>Subtopic: PROJECTILES</u>

- analyze quantitatively the horizontal and vertical motion of a projectile (325-6)

Subtopic: CIRCULAR MOTION

- describe uniform circular motion using algebraic and vector analysis (325-12)
- explain quantitatively circular motion using Newton's laws (325-13)

Subtopic: SIMPLE HARMONIC MOTION (SHM)

- explain qualitatively the relationship between displacement, velocity, time, and acceleration for simple harmonic motion (327-2)
- explain quantitatively the relationship between potential and kinetic energies of a mass in simple harmonic motion (327-4)

Subtopic: UNIVERSAL GRAVITATION

- explain qualitatively Kepler's first and second laws and apply quantitatively Kepler's third law (ACP-2)
- explain and apply the law of universal gravitation to orbital notations by using appropriate numeric and graphic analysis (215-2)

**Unit: Fields**

Subtopic: MAGNETIC, ELECTRIC, AND GRAVITATIONAL FIELDS

- describe magnetic, electric, and gravitational fields as regions of space that affect mass and charge (328-1)
- describe magnetic, electric, and gravitational fields by illustrating the source and direction of the lines of force (328-2)
- describe electric fields in terms of like and unlike charges, and magnetic fields in terms of poles (328-3)

Subtopic: COULOMB'S LAW

- compare Newton's law of universal gravitation with Coulomb's law, and apply both laws quantitatively (328-4)

Subtopic: ELECTRIC CIRCUITS (OPTIONAL)

- apply Ohm's law to series, parallel, and combination circuits (ACP-3)

Subtopic: ELECTROMAGNETISM AND ELECTROMAGNETIC INDUCTION

- describe the magnetic field produced by a current in a long, straight conductor, and in a solenoid (328-6)
- analyze qualitatively the forces acting on a moving charge in a uniform magnetic field (328-5)

- analyze qualitatively electromagnetic induction by both a changing magnetic flux and a moving conductor (328-7)

Subtopic: GENERATORS AND MOTORS

- compare and contrast the ways a motor and generator function, using the principles of electromagnetism (328-9)
- describe and compare direct current and alternating current (ACP-4)

**Unit: Waves and Modern Physics**

Subtopic: QUANTUM PHYSICS

- apply quantitatively the law of conservation of mass and energy using Einstein's mass-energy equivalence (326-9)
- describe how the quantum energy concept explains both black-body radiation and the photoelectric effect (327-9)
- explain qualitatively and apply the formula for the photoelectric effect (327-10)

Subtopic: COMPTON AND DE BROGLIE

- explain quantitatively the Compton effect and the de Broglie hypothesis, using the laws of mechanics, the conservation of momentum, and the nature of light (329-1)

Subtopic: PARTICLES AND WAVES

- summarize the evidence for the wave and particle models of light (327-11)

Subtopic: BOHR ATOMS AND QUANTUM ATOMS

- explain quantitatively the Bohr atomic model as a synthesis of classical and quantum concepts (329-2)
- explain the relationship among the energy levels in Bohr's model, the energy difference between levels, and the energy of the emitted photons (329-3)

**Unit: Radioactivity**

Subtopic: RADIOACTIVE DECAY

- describe the products of radioactive decay and the characteristics of alpha, beta, and gamma radiation (329-4)
- analyze data on radioactive decay to predict half-life (214-2)

Subtopic: FISSION AND FUSION

- compare and contrast fission and fusion (329-6)