

Physics 20: Year at a Glance for Grade 11

Overview

Physics 20 is organized into four units: Kinematics, Dynamics, Circular Motion, Work and Energy, and Oscillatory Motion and Mechanical Waves. Unit A, Kinematics, takes about 15% of the year and covers displacement, velocity, acceleration and two-dimensional motion under the theme of Change and Systems. Unit B, Dynamics, takes about 25% of the year and extends the study of motion to forces, Newton's laws, friction and gravitation, introducing the concept of fields to explain gravitational effects. Unit C, Circular Motion, Work and Energy, takes about 30% of the year and covers uniform circular motion, planetary and satellite motion, and the conservation of mechanical energy. Unit D, Oscillatory Motion and Mechanical Waves, also takes about 30% of the year and covers simple harmonic motion, mechanical resonance, and wave properties such as reflection, interference and the Doppler effect under the theme of Energy and Matter. Across all four units, students are encouraged to develop attitudes toward science, including mutual respect and stewardship. [See the curriculum: 1, 2, 3, 4, 5, 6.](#)

The year at a glance

Physics › Physics (20, 30) › Physics 20

Unit	General outcomes	Specific outcomes
Themes: Change and Systems Overview: In this unit, students investigate changes in the position and velocity of objects and systems in a study of kinematics.	Students will describe motion in terms of displacement, velocity, acceleration and time.	(none in the selection)

Themes: Change and Systems Overview: In this unit, students investigate causes of change in the position and velocity of objects and systems in a study of dynamics and gravitation.	Students will explain that gravitational effects extend throughout the universe.; Students will explain the effects of balanced and unbalanced forces on velocity.	## Communication and Teamwork Students will: 20-B2.4s work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results - select and use... (see the curriculum); Performing and Recording Students will: 20-B2.2s conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information - determine, empirically, the... (see the curriculum); ## Initiating and Planning Students will: 20-B2.1s formulate questions about observed relationships; plan investigations of questions, ideas, problems and issues - identify, define and delimit questions to investigate; *e.g., What is the... (see the curriculum); Students will: 20-B2.4k define the term "field" as a concept that replaces "action at a distance" and apply the concept to describe gravitational effects (see the curriculum); Students will: 20-B2.3k explain, qualitatively, the principles pertinent to the Cavendish experiment used to determine the universal gravitational constant, G (see the curriculum); ## Analyzing and Interpreting Students will: 20-B2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions - list the limitations of mass-weight determinations at different points on Earth's... (see the curriculum); Students will: 20-B2.2k describe, qualitatively and quantitatively, Newton's law of universal gravitation (see the curriculum); Students will: 20-B2.5k relate, qualitatively and quantitatively, using Newton's law of universal gravitation, the gravitational constant to the local value of the acceleration due to gravity (see the curriculum); Students will: 20-B2.6k predict, quantitatively, differences in the weight of objects on different planets. (see the curriculum); Students will: 20-B2.1k identify the gravitational force as one of the fundamental forces in nature (see the curriculum); Students will: 20-B2.1sts explain that concepts, models and theories are often used in interpreting and
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explaining observations and in predicting future observations (NS6a) - compare apparent weightlessness and zero net gravity - ... (see the curriculum); ##
 Performing and Recording Students will: 20-B1.2s conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information - conduct experiments to... (see the curriculum); Students will: 20-B1.5k explain, qualitatively and quantitatively, static and kinetic forces of friction acting on an object (see the curriculum); Students will: 20-B1.1k explain that a nonzero net force causes a change in velocity (see the curriculum); Students will: 20-B1.2sts explain that science and technology are developed to meet societal needs and that society provides direction for scientific and technological development (SEC1) (SEC4) [ICT F2-4.8] - *discuss the use of... (see the curriculum);
 Analyzing and Interpreting Students will: 20-B1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions - analyze a graph of empirical data to infer the mathematical relationships among... (see the curriculum); Students will: 20-B1.3sts explain that scientific knowledge and theories develop through hypotheses, the collection of evidence, investigation and the ability to provide explanations (NS2) - *analyze the trajectory of lunar dust... (see the curriculum)

Themes: Energy and Equilibrium Overview: In this unit, students extend their study of kinematics and dynamics to uniform circular motion and to mechanical energy, work and power.	Students will explain that work is a transfer of energy and that conservation of energy in an isolated system is a fundamental physical concept.; Students will explain circular motion, using Newton's laws of motion.	(none in the selection)
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Themes: Energy and Matter Overview: In this unit, students investigate simple harmonic motion and mechanical waves.	Students will describe the conditions that produce oscillatory motion.; Students will describe the properties of mechanical waves and explain how mechanical waves transmit energy.	Analyzing and Interpreting Students will: 20-D1.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions - relate the length of a pendulum to its period of oscillation (see the curriculum); Students will: 20-D1.3k explain, quantitatively, the relationships among displacement, acceleration, velocity and time for simple harmonic motion, as illustrated by a frictionless, horizontal mass-spring system or a pendulum, using the... (see the curriculum); ## Communication and Teamwork Students will: 20-D1.4s work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results - select and use... (see the curriculum); Students will: 20-D1.2k define simple harmonic motion as a motion due to a restoring force that is directly proportional and opposite to the displacement from an equilibrium position (see the curriculum); Students will: 20-D1.5k define mechanical resonance. (see the curriculum); Students will: 20-D1.4k determine, quantitatively, the relationships among kinetic, gravitational potential and total mechanical energies of a mass executing simple harmonic motion (see the curriculum); Students will: 20-D1.1sts explain that the goal of science is knowledge about the natural world (NS1) - analyze, qualitatively, the forces in real-life examples of simple harmonic motion: - *action of springs in vehicle... (see the curriculum); Students will: 20-D1.1k describe oscillatory motion in terms of period and frequency (see the curriculum); Performing and Recording Students will: 20-D1.2s conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information - perform an experiment to... (see the curriculum); Initiating and Planning Students will: 20-D1.1s formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues - design an experiment to demonstrate that simple harmonic motion can be... (see the
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curriculum); ## Communication and Teamwork Students will: 20-D2.4s work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results - select and use... (see the curriculum); Students will: 20-D2.7k explain, qualitatively, the phenomenon of reflection as exhibited by mechanical waves (see the curriculum); Students will: 20-D2.9k explain, qualitatively and quantitatively, the Doppler effect on a stationary observer of a moving source. (see the curriculum); Students will: 20-D2.5k describe how the speed of a wave depends on the characteristics of the medium (see the curriculum); Students will: 20-D2.1k describe mechanical waves as particles of a medium that are moving in simple harmonic motion (see the curriculum); Students will: 20-D2.1sts explain that the goal of technology is to provide solutions to practical problems (ST1) [ICT F2-4.4] [ICT F2-4.8] - *investigate the application of acoustic phenomena in recreation, medicine, industry and... (see the curriculum); Analyzing and Interpreting Students will: 20-D2.3s analyze data and apply mathematical and conceptual models to develop and assess possible solutions - determine the speed of a mechanical wave; e.g., water waves and sound waves... (see the curriculum); Students will: 20-D2.6k predict, quantitatively, and verify the effects of changing one or a combination of variables in the universal wave equation ($v = f\lambda$) (see the curriculum); Students will: 20-D2.8k explain, qualitatively, the conditions for constructive and destructive interference of waves and for acoustic resonance (see the curriculum); Initiating and Planning Students will: 20-D2.1s formulate questions about observed relationships and plan investigations of questions, ideas, problems and issues - *predict the conditions required for constructive and destructive... (see the curriculum); Performing and Recording Students will: 20-D2.2s conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information - draw

wave-front and ray... (see the curriculum); Students will: 20-D2.4k define the terms wavelength, wave velocity, period, frequency, amplitude, wave front and ray as they apply to describing transverse and longitudinal waves (see the curriculum); Students will: 20-D2.2k compare and contrast energy transport by matter and by waves (see the curriculum); Students will: 20-D2.3k define longitudinal and transverse waves in terms of the direction of motion of the medium particles in relation to the direction of propagation of the wave (see the curriculum)

Students will be encouraged to develop positive attitudes that support the responsible acquisition and application of knowledge related to science and technology.	Mutual Respect Students will be encouraged to: appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds; e.g., - *use a multiperspective approach,...; Stewardship Students will be encouraged to: demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment; e.g., - *assume part of the collective responsibility for the...; Collaboration Students will be encouraged to: work collaboratively in planning and carrying out investigations and in generating and evaluating ideas; e.g., - *provide the same attention and energy to the group's product as they...; Scientific Inquiry Students will be encouraged to: seek and apply evidence when evaluating alternative approaches to investigations, problems and issues; e.g., - *consider the social and cultural contexts in which a theory...; Interest in Science Students will be encouraged to: show interest in science-related questions and issues and confidently pursue personal interests and career possibilities within science-related fields; e.g., - *research the...; Safety Students will be encouraged to: show concern for safety in planning, carrying out and reviewing activities, referring to the Workplace Hazardous Materials Information System (WHMIS) and consumer product labelling information;...	(none in the selection)
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Across the year

- The four units build on one another in sequence: describing motion in Kinematics leads into explaining what causes motion in Dynamics, which extends into circular motion and energy, and finally into oscillatory motion and mechanical waves. [See the curriculum: 1, 2, 3, 4, 5.](#)
- The theme of Change and Systems links to Unit A, Kinematics, in the study of how changes in position and velocity of objects and systems are investigated [See the curriculum: 1, 2, 3, 4.](#)
- Each unit identifies related mathematics outcomes in measurement, trigonometry, graph analysis and slope, so physics problem sets can reinforce skills students are developing in their mathematics courses at the same time. [See the curriculum: 1, 2, 3, 4.](#)
- The attitude outcomes for mutual respect, stewardship, collaboration, scientific inquiry, interest in science, and safety are meant to be developed throughout all four units rather than taught as a stand-alone topic. [See the curriculum: 1, 2, 3, 4, 5, 6, 7.](#)