

What your student will study in Physics 20

Physics 20 is a senior high school course. It builds on foundational science and mathematics from earlier grades. The course focuses on motion, forces, and gravity. Your student will learn to describe and predict how objects move. They will understand why objects move the way they do. They will apply these principles to real-world problems in technology and engineering.

Throughout the course, your student will develop interest in science-related questions and issues. They will ask questions about how the world works. They will seek evidence to support explanations. They will explore and use a variety of methods and resources to increase their knowledge and skills. They will recognize the importance of making connections among various science disciplines. [See the curriculum: 1, 2, 3, 4, 5.](#)

What the course covers

Unit A: Kinematics

In this unit, your student investigates how objects change position and velocity over time. Kinematics is the study of motion itself, without asking what causes that motion. Your student will learn to define and measure displacement, which is the straight-line distance and direction from start to finish. They will understand velocity, which is how fast and in what direction something is moving. They will understand acceleration, which is how quickly velocity is changing. Your student will distinguish between scalar quantities, which have only magnitude (like speed), and vector quantities, which have both magnitude and direction (like velocity). The unit covers uniform motion, where velocity stays constant. It covers uniformly accelerated motion, where velocity changes at a steady rate. Your student will solve problems involving two-dimensional motion, such as projectile motion, by breaking motion into horizontal and vertical components. Laboratory work includes experiments using interval timers or motion sensors to gather data about moving objects. Your student will construct and analyze graphs showing relationships among displacement, velocity, acceleration and time. [See the curriculum: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.](#)

Unit B: Dynamics and Gravitation

This unit explains what causes objects to change their motion. Your student will study Newton's three laws of motion. The first law explains why objects at rest stay at rest and moving objects stay in motion unless a force acts on them. The second law quantifies how a net force causes acceleration, with the relationship $F = ma$. The third law states that forces always occur in pairs; when one object pushes on another, the second object pushes back with equal force in the opposite direction. Your student will apply these laws to analyze forces acting on objects, including friction, which is the resistance between surfaces in contact. Vector addition is used to find the resultant force when multiple forces act on an object. Your student will solve problems involving motion on horizontal, vertical, and inclined planes. The unit also introduces gravitation. Your student will learn that gravity is one of the fundamental forces in nature. They will study Newton's law of universal gravitation, which describes how any two masses attract each other. The concept of a gravitational field replaces the older idea of "action at a distance" and helps explain how gravity operates throughout the universe. Laboratory investigations include experiments to determine relationships among force, mass and acceleration using motion sensors. Your student will use free-body diagrams to visualize and analyze forces. [See the curriculum: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18.](#)

How the course is assessed

Physics 20 develops positive attitudes that support the responsible acquisition and application of knowledge related to science and technology. Students will be encouraged to develop positive attitudes that support the responsible acquisition and application of knowledge related to science and technology throughout Physics 20. Unit tests measure your student's understanding of the concepts

and ability to solve problems. Laboratory investigations and practical experiments are evaluated on how well your student gathers data, analyzes results, and communicates findings. Assignments, including problem sets and research tasks, allow your student to apply concepts to real-world applications such as traffic safety, aircraft design, and sports injury prevention. Your student will be expected to use correct scientific notation, SI units, and significant digits in all written work. Physics 20 is organized into units that develop specific outcomes for Knowledge, Science, Technology and Society (STS), and Skills.

How to support study at home

Build comfort with vectors and graphs. Your student will work with vectors, which are quantities that have both magnitude and direction. They will interpret graphs showing motion. Ask your student to explain the difference between displacement and distance. Ask them to describe what a steep slope on a velocity-time graph means. Working through these explanations aloud helps your student clarify thinking. [See the curriculum: 1, 2.](#)

Work through kinematics problems together. When your student brings home problem sets, ask them to talk through the steps. What do we know? What are we solving for? Which equation connects those quantities? Students will explain, qualitatively and quantitatively, uniform and uniformly accelerated motion when provided with written descriptions and numerical and graphical data. [See the curriculum: 1, 2.](#)

Discuss real-world applications. Physics 20 connects to everyday life. Ask your student how Newton's laws apply to a car's motion during braking. Ask why seat belts matter in a collision. Ask how traffic lights are timed based on vehicle acceleration. These conversations help your student see physics as practical knowledge, not abstract theory. [See the curriculum: 1, 2, 3, 4.](#)

Encourage careful laboratory work. If your student conducts experiments at school, ask what data they collected. Ask how they recorded it. Ask what patterns they noticed. Discuss sources of error and how they might improve the experiment next time. Students will conduct investigations into relationships among observable variables and use a broad range of tools and techniques to gather and record data and information. [See the curriculum: 1, 2.](#)

Help with unit review before tests. A week or two before a unit test, sit down and review the key concepts. What are the three Newton's laws? How do you add vectors? What does a free-body diagram show? Students will work collaboratively in addressing problems and apply the skills and conventions of science in communicating information and ideas and in assessing results. [See the curriculum: 1, 2.](#)

Know when to seek help. If your student is struggling with the mathematics, particularly with algebra, trigonometry, or interpreting graphs, encourage them to visit their teacher during office hours. They can use the school's tutoring resources. Physics 20 assumes solid mathematical skills. Early intervention prevents frustration. [See the curriculum: 1, 2.](#)

Note: 58 learning outcome blocks were left out to fit the 6000-token curriculum budget for this kind of material. Use "Split into parts" to generate one document per organizing idea.