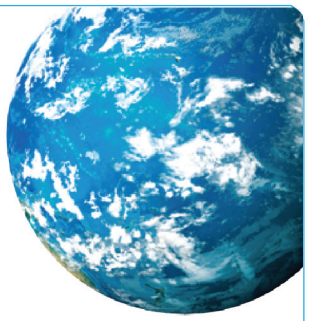
Discovery EDUCATION

Physics



Basics of Physics series

Exploring Energy Senior Primary - Junior Secondary **Duration:** 41 Minutes	Energy is very important to all that happens in our universe. It appears in many forms and is responsible for sustaining life on our planet. This program starts with an exploration of potential and kinetic energy and moves into a discussion of the main forms of energy; mechanical, heat, chemical, radiant, electrical, sound, and nuclear. In addition the program compares and contrasts non renewable and renewable energy resources. It also explores some of the problems and issues associated with our dependence on non renewable resources and encourages simple methods for conserving energy.
Exploring Gravity Senior Primary - Junior Secondary **Duration:** 19 Minutes	Gravity is often defined as simply the pull towards the centre of the earth. That definition is completely wrong. A person standing on the moon isn't going to think of gravity as the pull towards the centre of the earth. He or she is going to think of it as the pull towards the centre of the moon. Gravity is much more complex. It is a force that any two objects in the universe have towards each other. Anything made of matter has gravity. As students learn about gravity they will also explore mass, weight, weightlessness, and the law of universal gravitation. Skydivers and astronauts orbiting the earth in the space shuttle help to illustrate many of the ideas presented in this program.
Exploring Heat Senior Primary - Junior Secondary **Duration:** 28 Minutes	Heat is very important to all that happens in our universe. It appears in many forms and is responsible for sustaining life on our planet. This program starts with an exploration of heat and temperature. It discusses the different states of matter and how heat can change things from one state to another.
Exploring Light and Colour Senior Primary - Junior Secondary **Duration:** 31 Minutes	We collect 95% of all our input about the world around us through our sense of sight. This program describes how our eyes work and provides information about the nature of light and colour. People have been fascinated with light and eyes for a long time but their ideas have not always been correct. For instance, 2,000 years ago the Greeks thought that our eyes sent out rays of energy that struck an object and then returned to our eyes with information about the object. They thought this way because when they viewed the eyes of cats, dogs, and deer they noticed that the eyes of these animals were glowing. It was this glowing that they interpreted as a source of energy that was generated by the eyes. Today we know that our ability to see is totally dependent on reflected light. Light strikes an object and then some of it is absorbed and the rest is reflected or bounces off the object. It is this reflected light that enters our eyes.

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Exploring Sound Senior Primary - Junior Secondary **Duration:** 24 Minutes	Sounds play an important part of our world. We can identify things from the sounds they make or we associate certain sounds with particular objects or activities. This program describes how our ears work and the range of vibrations we are able to detect. The speed of sound and light are compared. The range of sounds that various animals can make and hear are discussed as well as concepts related to echo location. Other topics include frequency, reverberation, musical instruments, and the Doppler Effect.
Exploring the Laws of Motion Senior Primary - Junior Secondary **Duration:** 22 Minutes	This program is dedicated to Newton's Laws of Motion. Though Isaac Newton lived long before speedy forms of transportation he was able to formulate the three laws of motion which help to explain many of the natural phenomenon we come across on a regular basis. These three laws help us to understand why we are pulled from side to side on a speeding roller coaster or why we fall forward when the brakes of a car are suddenly applied. They help us to understand how a rocket is able to blast into space and then maneuver without brakes. Or they help us to understand the principles behind carnival and amusement park rides.
Discovering Simple Machines series	
Work and Energy Jnr Primary **Duration:** 13 Minutes	Students will learn that work to a scientist is very different from work as we might think of it. To a scientist, work is accomplished when an object with resistance is moved a distance. So, to a scientist, reading an assignment in a textbook represents no work. Potential and kinetic energy are discussed and illustrated, as well as forces such as friction that slow objects down.
Physical Science series	
Structures Senior Primary - Junior Secondary **Duration:** 21 Minutes	Structures such as suspension bridges, skyscrapers, and tunnels are marvels of engineering, but sometimes the engineering isn't quite so marvelous. Such was the case with the Tacoma-Narrows Bridge, which couldn't take the force of high winds. Italy's famous Tower of Pisa tilts because it was built on soft ground. Engineers and architects face many challenges when designing structures. The structures have to withstand the elements, bear weight, and distribute energy without moving too much or too little. Planners even have to account for seasickness when designing skyscrapers! Some tunnels have to hold up under the weight of an ocean. It's truly amazing that buildings, bridges, and tunnels can do what we need them to. What's even more amazing is that 5,000 years ago the Egyptians built the pyramids with such precision. To this day, we don't know how they accomplished it.
Physics series	
Physics **Duration:** 29 Minutes	Students use torsion balance, in a quantitative analysis of the relationship among charge, distance and electrostatic force, to verify Coulomb's law. They compare, analytically, Coulomb's law of electrostatic force and Newton's law of universal gravitational force.

Physics: A World in Motion series	
Atomic Spectra Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students observe the visible spectra of a number of gases, and in the process begin to see the analytical power of spectral analysis. This line of thought leads to a number of applications and Rutherford's model of the atom.
Biomedical Applications of EMR Middle Secondary - Senior Secondary **Duration:** 29 Minutes	The relative energy of electromagnetic waves of different frequencies is discussed in terms of their penetrating ability in human tissue. The student's exploration focuses on the many EMR devices used in biomedical applications. Using the risk-benefit model, they discuss the merits of tanning during a planned vacation.
Charge on the Electron Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students repeat the procedure used by R.A. Millikan in his oil-drop experiment. They measure, collect and carry out a detailed analysis of the data to determine the charge on one electron. With the help of a model, they reinforce vector addition of forces and terminal velocity as applied in the procedure and analysis of Millikan's experiment.
Charge to Mass Ratio Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students complete a detailed analysis of J.J. Thomson's charge-to-mass ratio experiment. They use this data to calculate the ratio of charge to mass for one electron. The concepts used in the investigation are linked to television technology.
Charged Particles in Magnetic Fields Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Auroras provide a context to study moving charges within a magnetic field. Students learn that moving electric charges experience a force in magnetic fields and discover how to quantify this force and find its direction using hand rules.
Collinear Momentum Middle Secondary - Senior Secondary **Duration:** 29 Minutes	The biathlon provides the context for investigating the law of conservation of momentum in the laboratory and on location. Students identify different types of collisions in which momentum is conserved: explosion, hit and stick, and hit and rebound. They develop an appropriate quantitative problem solving strategy for each.
Conservation of Momentum and Energy Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Exploring the physics of a soccer game, a projectile spring and a ballistic pendulum, students apply their understanding of the concepts of energy and momentum. Problem solving and combining many physics ideas into one solution are emphasised.
Coulomb Forces in Nature **Middle Secondary - Senior Secondary** **Duration:** 29 Minutes	Ionic crystals provide students with a real-life application of quantifying electrostatic forces between point charges. They use large sized models to facilitate advanced Coulomb's law problem solving, using vectors and vector components.

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Current Electricity Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students are challenged to devise a source of potential difference from provided materials. Throughout the program, they investigate electric current concepts by discussion, laboratory work and interviews. They complete calculations involving the change in energy for various loads in an electric circuit.
Elastic and Inelastic Collisions Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Elastic and inelastic collisions are analysed. A montage of sports images leads students to recognise most collisions as inelastic. With teacher guidance, students use criteria of conservation of kinetic energy for elastic collisions to solve for an unknown quantity in several examples.
Electric Fields Between Plates Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Investigating the shape of electric fields between and around plates, students discover the uniformity of such fields. They analyse the behaviour of moving electric charges in uniform fields quantitatively, using vector sum calculations. Lightning and particle accelerators provide a context for reviewing the effects of electric fields.
Electrical Potential Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Comparing electric and gravitational effects, students define electric potential and electric potential difference. Students compare a ride on a water slide to the effects of potential difference on charged particles. Lightning and particle acceleration are explained using the concept of electrical potential.
Electromagnetic Forces Middle Secondary - Senior Secondary **Duration:** 29 Minutes	The concept of electromagnetism is introduced and investigated. Students then apply principles learned in the lab to workings of a malfunctioning speaker.
Electromagnetic Waves and Communication Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Emphasis is placed on how transmission and reception occur through a studio model of a transmitter and receiver and interviews with experts. Students explore the roles of different parts of the EMR spectrum in telecommunications.
Electrostatics Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Historic views, from the two-fluid concept of the Greeks to Franklin's single positive fluid, lead students to understand electrostatic charge in terms of electrons, as based on the atomic model of matter. Concepts of electrostatics are developed as students consider static charge build up, the dangers of uncontrolled discharge, and controlled discharge in everyday situations.
EMR and the Stars Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students discover that astronomers use different parts of the electromagnetic spectrum to explore the universe. They discuss the value of satellite observing platforms, explore possible situations to ground based viewing, and compare images of the same object obtained using different wavelengths.

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EMR Fundamentals Middle Secondary - Senior Secondary **Duration:** 29 Minutes	The historic development (Oersted, Ampere, Faraday and Maxwell) of electromagnetic theory is a major focus. Students perform a variety of mini-labs to demonstrate the wave-like behaviour of EMR -specifically microwaves- and they undertake a research project to investigate the constituents of the electromagnetic spectrum.
Energy Conservation Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students analyse the transformation of gravitational potential energy to kinetic energy using algebraic and graphical means. The motion of mass on a spring, a bungee jump and an athlete on a trampoline provide the data for detailed analyses that support the principle of energy conservation.
Energy Transformation Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students use the work-energy theorem to solve problems involving a change of gravitational potential energy to mechanical kinetic energy and the work done against friction. Roller coasters, water slides and athletic events provide real-world examples for algebraic and graphical analysis.
Fields Around Point Charges Middle Secondary - Senior Secondary **Duration:** 29 Minutes	The concept of field and field strength around point charges is developed from the parallel ideas in gravitation. Students investigate the shape of electric fields around point charges and quantify field strengths and forces.
Fission and Fusion Middle Secondary - Senior Secondary **Duration:** 29 Minutes	This program looks to the future. In the context of speculating how electricity will be generated 40 years from now, students investigate the nature of fission and fusion, comparing these two options to a coal-fired system.
From Cathode Rays to X-Rays Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students trace historical events that led up to the discovery of cathode rays and X-rays, including limitations imposed upon scientists by the available technology and their attempts to overcome these problems. Students find that science often progresses in a haphazard way: one chance observation may lead to a whole new field of inquiry with a completely unexpected set of applications.
Generator Effect Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students investigate induction and provide explanations of the effect based on their knowledge of magnetic field-current interactions. In discussion with musicians and audio recording personnel, students apply the concept of electromagnetic induction to sound equipment and investigate the workings of an acoustic microphone and magnetic tape playback equipment.
Kirchhoff's Rules Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students survey the development of electrical systems in automobiles, starting with cars from the turn of the century and ending with a hybrid electric vehicle. Using a component of automobile circuitry as a model, students apply Kirchhoff's rules, and make the connection to conservation of charge and energy.

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Lenz's Law Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students investigate the self regulating nature of electric motor speeds and discover the application of Lenz's law as a method of explaining the event. They complete measurements and calculations based on conservation of energy to determine the back EMF of an electric motor. The Meissner effect and induction furnaces are compared and contrasted in terms of eddy currents and energy conversions.
Magnetism Middle Secondary - Senior Secondary **Duration:** 29 Minutes	During their investigation of magnetism, students examine the use of a compass needle in navigation and link its behaviour to the Earth's magnetic field. They explain how other common magnetic objects work and are challenged to identify the connection between an aurora display and magnets.
Momentum and Impulse Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students gather information from two police officers - a vehicle safety expert and a self defence instructor - and use it in an exploration of the concepts of momentum and impulse. Teacher guided analyses relate additional demonstrations of the principles of momentum and impulse.
Momentum: Vector Addition Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Student explore the conservation of momentum in two dimensions on location at a curling rink and in the laboratory with an air table. They use orthogonal components to make two-dimensional analysis uniform. They then apply conservation to the analysis of an automobile accident.
Motor Effect Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students apply motor-effect principles to the design of electric DC motors. They also perform a quantitative investigation to determine the force on a conductor in a magnetic field. Design, advantages and applications of DC motors are presented.
Networks Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students develop a five-step procedure for analysing networks circuits and use it to analyse a model circuit built by referring to historic trolleys. Alternatives for public transit are identified using a risk-benefit model.
Ohm's Law and Energy Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students investigate the nature of resistance and its connection to safety when dealing with electric circuits. Locations interviews focus on the dangers posed by electric current, and methods of avoiding those dangers. Using Ohm's law and the power equation, students quantify the energy transfers occurring in theoretically valid situations and in laboratory experiment work.
Radioactive Decay Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Radioactive decay is introduced using radioactive dating of artifacts and fossils as examples. Students learn to describe decay in terms of nuclear equations and half-life calculations. They practice half-life calculations using radioactive tracers.

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Radioactivity Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Radioactivity is introduced. Students explore the properties of alpha, beta and gamma radiation and conduct a risk-benefit assessment, in the context of food irradiation.
Risk-Benefit Analysis Middle Secondary - Senior Secondary **Duration:** 29 Minutes	In the process of exploring benefits and risks in personal safety equipment, students develop a generic Risk-Benefit Assessment model. Students use the model to reach personal decisions regarding the use of bicycle helmets.
Series and Parallel Circuits Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students gather and analyse quantitative data of simple series and parallel circuits. Their analysis develops mathematical expressions describing the relationships among current, voltage, resistance and power in electric circuits. They apply the concepts, both quantitatively and qualitatively, to describe the functioning of historic trolley trains.
The Bohr Model of the Atom Middle Secondary - Senior **Secondary** **Duration:** 29 Minutes	The ideas of the atomic spectra and the specifics of the hydrogen spectrum are synthesised to present Bohr's model of the hydrogen atom. The laser provides a context for discussing energy levels and emission of radiation due to energy transitions.
The Hydrogen Spectrum Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students use the Rydberg equation to quantitatively analyse the hydrogen gas spectrum. The idea of energy levels within the hydrogen atom is introduced. Using the Doppler effect, they make the connection between absorption spectra and the motion of galaxies.
The Photoelectric Effect Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Collecting and analysing data, students investigate the photoelectric effect and begin to quantify the photon model of light. They apply the concepts to photosynthesis, photovoltaic cells, CCDs and vision.
The Photon Model of Light Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students observe the behaviour of light in experiments involving black body radiation and the photoelectric effect. They analyse their observations from the point of view of Maxwell's (classical) model of light. This leads them to understand that a new model for light is required to explain the results.
The Quantum Mechanical Model Middle Secondary - Senior Secondary **Duration:** 29 Minutes	The phenomena of fluorescence and phosphorescence provide the context for students to explore, qualitatively, the main ideas of the quantum mechanical model of the atom.

Transferring Charge Middle Secondary - Senior Secondary **Duration:** 29 Minutes	A viewer challenge, to explain Rice Krispies being initially attracted to a charged rod then flying off, introduces charging by conduction and induction. Students use a Van de Graaf generator and conduct interviews with a rock climber, photocopier technician and aerospace engineer, as they explore charging by conduction and induction.
Transformers Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students discover the operating principles of the transformer and gather empirical evidence to deduce the relationships among the important variables at work. They assess the benefits of voltage transmission and explain how technology favoured the use of AC.
Two-Dimensional Collisions Middle Secondary - Senior Secondary **Duration:** 29 Minutes	Students explore the concept of conservation of momentum in two dimensions in the context of fireworks, bumper cars, open pit mining, and within the isolated system of an air table. The problem solving strategy using components is reinforced.
Wave Particle Duality Middle Secondary - Senior Secondary **Duration:** 29 Minutes	The medical uses of X-rays motivate students to examine X-ray production, the photoelectric and Compton effects, and wave-particle duality as it applies to photons. De Broglie's notion of matter waves is introduced as another example of wave-particle duality.
Work and Energy Snr Secondary **Duration:** 29 Minutes	Elevators, escalators, and an amusement park ride illustrate mechanical energy transformations and provide data for students to calculate the work done and power developed. Students examine a number of athletic activities illustrating the principles of work, power and energy, and analyse data obtained from an air table.
Real World Science series	
Forces Middle Primary - Senior Primary **Duration:** 18 Minutes	The Real World Science video series has been designed to help students relate to how topics they study in school function in their daily lives. In Real World Science: Forces, students will learn through observation and experimentation about forces and motion. By viewing this program, students will come to understand that every force is a push or pull, balanced and unbalanced forces, friction, gravity, electromagnetism, and pressure as well as Newton's Laws of Motion. Provides vivid support for Science and Physics units on forces and Newton's three Laws of Motion.
Work, Energy, and the Simple Machine series	
Work and Energy Jnr Secondary **Duration:** 15 Minutes	To understand how the simple machines are helpful to humans we must first understand principles associated with work and energy. Work to a scientist is only accomplished when an effort is used to move an object that has resistance. Potential and kinetic energy are discussed as well as forces that impede the motion of objects such as friction.