# Science
# Physics: Honors
# Unit 7: Electricity

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| **Essential Understandings** | ▪ Conceptual:<br>o The reoccurring fundamental principles elaborated in physics have uses and implications in every dimension of modern life.<br>o Physics seeks to analyze and understand every system as a demonstration of the cause-effect relationship.<br>▪ Computational:<br>o Physics quantifies each variable of a system in order to describe, analyze and understand it.<br>o A variety of problem solving techniques make use of a system's quantities to investigate the conceptual relationships evidenced within the system.<br>o Numerical problem solving is an essential component in developing a clear understanding of the conceptual relationships identified within any system. |
| **Essential Questions** | ▪ How is the charge of an electron and a proton quantified?<br>▪ Why is the conservation of charge important?<br>▪ How can Coulomb's Law allow us to calculate forces on charges?<br>▪ How can we determine the magnitude of an electric field?<br>▪ Why is shielding important in electrical systems?<br>▪ How does flux relate to charge enclosed by a given surface?<br>▪ How is electric potential different from electric potential energy? |
| **Essential Knowledge** | ▪ There is a certain amount of charge in the universe. We can only move and redistribute that charge.<br>▪ Like charges repel and unlike charges attract.<br>▪ Conductance relates to the outer electrons in the atoms of matter.<br>▪ Electric fields are force per unit charge.<br>▪ Gauss's Law relates the charge enclosed to the electric flux through the surface.<br>▪ A capacitor is a device that stores electric charge. |
| **Vocabulary** | ▪ Terms:<br>o charge, insulator, conductor, polarization, superposition, spherical charge distribution, electric field, electric field lines, shielding, electric flux, electric potential, electric potential energy, equipotential surfaces |
| **Essential Skills** | ▪ Calculate the forces on a charged particle by other charged particles<br>▪ Calculate the field at any location around a matrix of charged particles.<br>▪ Calculate the flux through a surface.<br>▪ Draw electric field lines.<br>▪ Calculate the speed of a charge in a field<br>▪ Determine the capacitance of various geometries of charged objects. |

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| **Related Maine Learning Results** | Science and Technology<br>A. Unifying Themes<br>A1.Systems<br>Students apply an understanding of systems to explain and analyze man-made and natural phenomena.<br>a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem.<br>b. Explain and provide examples that illustrate how it may not always be possible to predict the impact of changing some part of a man-made or natural system.<br>C. The Scientific and Technological Enterprise<br>C4.History and Nature of Science<br>Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society.<br>a. Describe the ethical traditions in science including peer review, truthful reporting, and making results public.<br>b. Select and describe one of the major episodes in the history of science including how the scientific knowledge changed over time and any important effects on science and society.<br>c. Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists.<br>d. Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones. |

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| **Related Maine Learning Results** | D. The Physical Setting<br>D3. Matter and Energy<br>Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy.<br>a. Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties.<br>b. Describe how the number and arrangement of atoms in a molecule determine a molecule's properties, including the types of bonds it makes with other molecules and its mass, and apply this to predictions about chemical reactions.<br>c. Explain the essential roles of carbon and water in life processes.<br>d. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance.<br>e. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules).<br>f. Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions.<br>g. Describe nuclear reactions, including fusion and fission, and the energy they release.<br>h. Describe radioactive decay and half-life.<br>i. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems.<br>j. Describe how in energy transformations the total amount of energy remains the same, but because of inefficiencies (heat, sound, and vibration) useful energy is often lost through radiation or conduction.<br>k. Apply an understanding of energy transformations to solve problems.<br>l. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions. |
| **Sample Lessons And Activities** | ▪ Actively read the text book completing the examples presented.<br>▪ Individually answer conceptual questions and solve problems.<br>▪ Collectively discuss the answers and solutions in class.<br>▪ Discuss real world examples of concepts presented in the textbook and encountered in the real world.<br>▪ Techtronix Circuit building laboratories |

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| **Sample Classroom Assessment Methods** | ▪ Homework assignments.<br>▪ Assess understanding in classroom discussions.<br>▪ Written examinations with real world conceptual questions and numerical problems. |
| **Sample Resources** | ▪ Publications:<br>○ Physics Second Edition - James S. Walker<br>▪ Videos:<br>○ Mechanical Universe Video Series<br>▪ Other Resources:<br>○ Companion Website: http://physics.prenhall.com/walker<br>○ Physics Demonstrations in Mechanics<br>○ Gibson's Techtronic curriculum and kits |