

Brunswick School Department
Physics: Honors
Electricity

Essential Understandings	<ul style="list-style-type: none"> ▪ <u>Conceptual:</u> <ul style="list-style-type: none"> ○ The reoccurring fundamental principles elaborated in physics have uses and implications in every dimension of modern life. ○ Physics seeks to analyze and understand every system as a demonstration of the cause-effect relationship. ▪ <u>Computational:</u> <ul style="list-style-type: none"> ○ Physics quantifies each variable of a system in order to describe, analyze and understand it. ○ A variety of problem solving techniques make use of a system's quantities to investigate the conceptual relationships evidenced within the system. ○ Numerical problem solving is an essential component in developing a clear understanding of the conceptual relationships identified within any system.
Essential Questions	<ul style="list-style-type: none"> ▪ How is the charge of an electron and a proton quantified? ▪ Why is the conservation of charge important? ▪ How can Coulomb's Law allow us to calculate forces on charges? ▪ How can we determine the magnitude of an electric field? ▪ Why is shielding important in electrical systems? ▪ How does flux relate to charge enclosed by a given surface? ▪ How is electric potential different from electric potential energy?
Essential Knowledge	<ul style="list-style-type: none"> ▪ There is a certain amount of charge in the universe. We can only move and redistribute that charge. ▪ Like charges repel and unlike charges attract. ▪ Conductance relates to the outer electrons in the atoms of matter. ▪ Electric fields are force per unit charge. ▪ Gauss's Law relates the charge enclosed to the electric flux through the surface. ▪ A capacitor is a device that stores electric charge.
Vocabulary	<ul style="list-style-type: none"> ▪ <u>Terms:</u> <ul style="list-style-type: none"> ○ 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	<ul style="list-style-type: none"> ▪ Calculate the forces on a charged particle by other charged particles ▪ Calculate the field at any location around a matrix of charged particles. ▪ Calculate the flux through a surface. ▪ Draw electric field lines. ▪ Calculate the speed of a charge in a field ▪ Determine the capacitance of various geometries of charged objects.

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Related Maine Learning Results	<p><u>Science and Technology</u></p> <p>A. Unifying Themes</p> <p>A1. Systems</p> <p>Students apply an understanding of systems to explain and analyze man-made and natural phenomena.</p> <ol style="list-style-type: none">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.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. <p>C. The Scientific and Technological Enterprise</p> <p>C4. History and Nature of Science</p> <p>Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society.</p> <ol style="list-style-type: none">Describe the ethical traditions in science including peer review, truthful reporting, and making results public.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.Give examples that show how societal, cultural, and personal beliefs and ways of viewing the world can bias scientists.Provide examples of criteria that distinguish scientific explanations from pseudoscientific ones.
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<p style="text-align: center;">Related Maine Learning Results</p>	<p>D. The Physical Setting</p> <p>D3.Matter and Energy</p> <p>Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy.</p> <ol style="list-style-type: none"> Describe the structure of atoms in terms of neutrons, protons, and electrons and the role of the atomic structure in determining chemical properties. 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. Explain the essential roles of carbon and water in life processes. Describe how light is emitted and absorbed by atoms' changing energy levels, and how the results can be used to identify a substance. Describe factors that affect the rate of chemical reactions (including concentration, pressure, temperature, and the presence of molecules that encourage interaction with other molecules). Apply an understanding of the factors that affect the rate of chemical reaction to predictions about the rate of chemical reactions. Describe nuclear reactions, including fusion and fission, and the energy they release. Describe radioactive decay and half-life. Explain the relationship between kinetic and potential energy and apply the knowledge to solve problems. 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. Apply an understanding of energy transformations to solve problems. Describe the relationship among heat, temperature, and pressure in terms of the actions of atoms, molecules, and ions.
<p style="text-align: center;">Sample Lessons And Activities</p>	<ul style="list-style-type: none"> ▪ Actively read the text book completing the examples presented. ▪ Individually answer conceptual questions and solve problems. ▪ Collectively discuss the answers and solutions in class. ▪ Discuss real world examples of concepts presented in the textbook and encountered in the real world. ▪ Techtronix Circuit building laboratories

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Sample Classroom Assessment Methods	<ul style="list-style-type: none">▪ Homework assignments.▪ Assess understanding in classroom discussions.▪ Written examinations with real world conceptual questions and numerical problems.
Sample Resources	<ul style="list-style-type: none">▪ <u>Publications:</u><ul style="list-style-type: none">○ <u>Physics</u> Second Edition - James S. Walker▪ <u>Videos:</u><ul style="list-style-type: none">○ <u>Mechanical Universe</u> Video Series▪ <u>Other Resources:</u><ul style="list-style-type: none">○ Companion Website: http://physics.prenhall.com/walker○ Physics Demonstrations in Mechanics○ Gibson's Techtronic curriculum and kits