

Carter County NGSS Science Curriculum

Unit Title/Topic: Field Forces	Grade: 11	Time: 2 weeks
<p>Performance Expectations:</p> <p>HS-PS2-4. Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. [Clarification Statement: Emphasis is on both quantitative and conceptual descriptions of gravitational and electric fields.] [Assessment Boundary: Assessment is limited to systems with two objects.]</p> <p>HS-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. [Assessment Boundary: Assessment is limited to designing and</p> <p>HS-PS3-5. Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. [Clarification Statement: Examples of models could include drawings, diagrams, and texts, such as drawings of what happens when two charges of opposite polarity are near each other, including an explanation of how the change in energy of the objects is related to the change in energy of the field.] [Assessment Boundary: Assessment is limited to systems</p>		
<p>Learning Targets/I Cans:</p> <ol style="list-style-type: none"> 1. I can define a field force. 2. I can predict the strength of field forces. 3. I can predict the cause and effect of field forces. 4. I can explain the relationship between electrical current and magnetic forces. 5. I can design and conduct an experiment investigating various field forces. 		
<p>Science and Engineering Practices</p> <p>Planning and Carrying Out Investigations</p> <p>Planning and carrying out investigations to answer questions or test solutions to problems in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical and empirical models.</p> <ul style="list-style-type: none"> Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS2-5) <p>Analyzing and Interpreting Data</p> <p>Analyzing data in 9–12 builds on K–8 and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.</p> <ul style="list-style-type: none"> Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HSPS2) <p>Using Mathematics and Computational Thinking</p> <p>Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including</p>	<p>Disciplinary Core Ideas</p> <p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none"> Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4) Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4),(HS-PS2-5) <p>PS3.A: Definitions of Energy</p> <ul style="list-style-type: none"> ...and "electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. 	<p>Crosscutting Concepts</p> <p>Systems and System Models</p> <ul style="list-style-type: none"> When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2) <p>Connections to other DCIs in this grade-band: HS.PS3.A (HS-PS2-4),(HS-PS2-5); HS.PS3.C (HS-PS2-1); HS.PS4.B (HS-PS2-5); HS.ESS1.B (HS-PS2-4); HS.ESS2.A (HS-PS2-5)</p> <p>Articulation to DCIs across grade-bands: MS.PS1.A (HS-PS2-5); MS.PS2.A (HS-PS2-1),(HS-PS2-2),(HS-PS2-3); MS.PS2.B (HS-PS2-4),(HS-PS2-5); MS.PS3.C (HS-PS2-1),(HS-PS2-2),(HS-PS2-3); MS.ESS1.B (HS-PS2-4),(HS-PS2-5)</p> <p>Common Core State Standards Connections: April 2013</p>

<p>trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.</p> <ul style="list-style-type: none"> ▪ Use mathematical representations of phenomena to describe explanations. (HS-PS2-2),(HS-PS2-4) <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> ▪ Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3) <p>Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> ▪ Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3) <p>-----</p>		
<p>Critical Content Vocabulary: Left hand rule, right hand rule, field lines, inductive forces, Coulomb’s Law, Newton’s gravitational constant (formula), Coulomb, Ampere, Ohms, Voltage, Polarity ,</p>		
<p>Resources: Discovery Education, Internet, Various lab equipment</p>		