Diocese of Greensburg Curriculum
Physics

Unit	Standards	Content	Skills
Math You Need to Know	**CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12** **CCSS: Grades 11-12** **Reading: Science & Technical Subjects** **Key Ideas and Details** **1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.** **2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.** **Craft and Structure** **4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.** **Integration of Knowledge and Ideas** **7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.** **10. Read and comprehend complex literary and informational texts independently and proficiently.** . **CCSS: Mathematics** **CCSS: HS: Num/Quantity** **Vector & Matrix Quantities** **HSN-VM.A. Represent and model with vector quantities.** **HSN-VM.B. Perform operations on vectors.** **Mathematical Practice** **MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.** **CCSS: HS: Algebra**	• Mathematical concepts as applied within a physics context • Analyze and interpret graphical data	Students will be able to: • Distinguish how mathematical concepts are applied within a physics context • Correctly analyze and interpret graphical data • Demonstrate proficiency in calculator and spreadsheet operations

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	Seeing Structure in Expressions **HSA-SSE.A. Interpret the structure of expressions.** **HSA-SSE.B. Write expressions in equivalent forms to solve problems.** **Creating Equations** **HSA-CED.A. Create equations that describe numbers or relationships.** **Reasoning with Equations & Inequalities** **HSA-REI.B. Solve equations and inequalities in one variable.** **HSA-REI.C. Solve systems of equations.** . **Mathematical Practice** **MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students**. **CCSS: HS: Functions** **Interpreting Functions** **HSF-IF.C. Analyze functions using different representations.** **Building Functions** **HSF-BF.A. Build a function that models a relationship between two quantities.** **Trigonometric Functions** **HSF-TF.A. Extend the domain of trigonometric functions using the unit circle.** **HSF-TF.B. Model periodic phenomena with trigonometric functions.** 		
Introduction to Physics	**NGSS: Science Performance Expectations (2013)** **NGSS: HS Engineering Design** **HS.Engineering Design** **Performance Expectations** **NGSS: Science and Engineering Practices** **NGSS: 9-12**	• Scientific method • Standard notation, scientific and prefix notation • Measurements • Accuracy and precision	Students will be able to: • Distinguish that science is but one way to acquire knowledge. • Recognize that science uses a methodology known as the scientific method to

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	Practice 5. Using mathematics and computational thinking **Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including 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.** **Practice 6. Constructing explanations (for science) and designing solutions (for engineering)** **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.** **NGSS: Crosscutting Concepts** **NGSS: 9-12** **Crosscutting Statements** **1. Patterns – Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.** **2. Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.** **7. Stability and Change – For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.** Access the interactive version of the NGSS here	• Dimensional analysis	relate observation to theory and understanding. • Convert numbers between standard notation, scientific and prefix notation. • Analyze measurements for error. • Distinguish between accuracy and precision. • Use dimensional analysis. • Recognize and describe the impact of science on society

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Introduction to Motion	**CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12** **CCSS: Grades 11-12** **Reading: Science & Technical Subjects** **Key Ideas and Details** **1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.** **2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.** **Craft and Structure** **4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.** **Integration of Knowledge and Ideas** **7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.** **8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.** **9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.** **Writing** **Text Types and Purposes** **1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.** **2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.** **Production and Distribution of Writing** **4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.** **6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.**	• Motion of objects • Trajectory • Average velocity • Speed and velocity • Distance and displacement	Students will be able to: • Predict the motion of an object based on its trajectory • Create position - time graphs/plots and motion diagrams from equations of motion • Create equations of motion from position - time graphs/plots and motion diagrams • Analyze the effect of initial position on average velocity • Distinguish between speed and velocity and distance and displacement • Design experiments that allow the speed and velocity of object to be measured • Solve one dimensional motion problems with constant acceleration

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	CCSS: Mathematics **CCSS: HS: Num/Quantity** **Quantities** **HSN-Q.A. Reason quantitatively and use units to solve problems.** **Mathematical Practice** **MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.** **CCSS: HS: Algebra** **Seeing Structure in Expressions** **HSA-SSE.A. Interpret the structure of expressions.** **HSA-SSE.B. Write expressions in equivalent forms to solve problems.** **Creating Equations** **HSA-CED.A. Create equations that describe numbers or relationships.** **Reasoning with Equations & Inequalities** **HSA-REI.B. Solve equations and inequalities in one variable.** **HSA-REI.D. Represent and solve equations and inequalities graphically.** **Mathematical Practice** **MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.** **CCSS: HS: Functions** **Interpreting Functions** **HSF-IF.C. Analyze functions using different representations.** **Building Functions** **HSF-BF.A. Build a function that models a relationship between two quantities.** . **NCTM: Mathematics**		

Unit	Standards	Content	Skills
	NCTM: Grades 9 - 12 **Number & Operations** **Understand meanings of operations and how they relate to one another** **Compute fluently and make reasonable estimates** **Algebra** **Understand patterns, relations, and functions** **Represent and analyze mathematical situations and structures using algebraic symbols** **Use mathematical models to represent and understand quantitative relationships** **Geometry** **Specify locations and describe spatial relationships using coordinate geometry and other representational systems** **Measurement** **Understand measurable attributes of objects and the units, systems, and processes of measurement** **Apply appropriate techniques, tools, and formulas to determine measurements** **NGSS: Science and Engineering Practices** **NGSS: 9-12** **Practice 1. Asking questions (for science) and defining problems (for engineering)** **Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.** **Practice 2. Developing and using models** **Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.** **Practice 3. Planning and carrying out investigations** **Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that**		

Unit	Standards	Content	Skills
	provide evidence for and test conceptual, mathematical, physical, and empirical models. **Practice 4. Analyzing and interpreting data** **Analyzing data in 9–12 builds on K–8 experiences 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.** **Practice 5. Using mathematics and computational thinking** **Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including 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.** **Practice 8. Obtaining, evaluating, and communicating information** **Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.** **NGSS: Crosscutting Concepts** **NGSS: 9-12** **Crosscutting Statements** **1. Patterns – Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.** **2. Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.** **7. Stability and Change – For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.**		

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	Much of science deals with constructing explanations of how things change and how they remain stable. 		
Accelerated Motion	**CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12** **CCSS: Grades 11-12** **Reading: Science & Technical Subjects** **Key Ideas and Details** **1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.** **2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.** **Craft and Structure** **4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.** **Integration of Knowledge and Ideas** **7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.** **8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.** **9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.** **Writing** **Text Types and Purposes** **1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.** **2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and**	• Motion of an object's velocity • Velocity and acceleration • Gravitational acceleration • Constant acceleration	Students will be able to: • Predict the motion of an object based on its initial conditions • Create velocity - time graphs/plots and motion diagrams from equations of motion • Create equations of motion from velocity - time graphs/plots and motion diagrams • Analyze the effect of initial velocity and acceleration on displacement • Design experiments that allow the gravitational acceleration to be determined • Solve one dimensional motion problems subject to constant acceleration

Unit	Standards	Content	Skills
	accurately through the effective selection, organization, and analysis of content. **Production and Distribution of Writing** **4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.** **6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.** **CCSS: Mathematics** **CCSS: HS: Algebra** **Seeing Structure in Expressions** **HSA-SSE.A. Interpret the structure of expressions.** **HSA-SSE.B. Write expressions in equivalent forms to solve problems.** **Creating Equations** **HSA-CED.A. Create equations that describe numbers or relationships.** **Reasoning with Equations & Inequalities** **HSA-REI.B. Solve equations and inequalities in one variable.** **HSA-REI.D. Represent and solve equations and inequalities graphically.** **Mathematical Practice** **MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.** **CCSS: HS: Functions** **Interpreting Functions** **HSF-IF.B. Interpret functions that arise in applications in terms of the context.**		

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	HSF-IF.C. Analyze functions using different representations. **Building Functions** **HSF-BF.A. Build a function that models a relationship between two quantities.** **NCTM: Mathematics** **NCTM: Grades 9 - 12** **Number & Operations** **Understand numbers, ways of representing numbers, relationships among numbers, and number systems** **Understand meanings of operations and how they relate to one another** **Compute fluently and make reasonable estimates** **Algebra** **Understand patterns, relations, and functions** **Represent and analyze mathematical situations and structures using algebraic symbols** **Use mathematical models to represent and understand quantitative relationships** **NGSS: Science and Engineering Practices** **NGSS: 9-12** **Practice 1. Asking questions (for science) and defining problems (for engineering)** **Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.** **Practice 2. Developing and using models** **Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict**		

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	and show relationships among variables between systems and their components in the natural and designed worlds. **Practice 3. Planning and carrying out investigations** **Planning and carrying out investigations 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.** **Practice 4. Analyzing and interpreting data** **Analyzing data in 9–12 builds on K–8 experiences 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.** **Practice 5. Using mathematics and computational thinking** **Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including 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.** **Practice 6. Constructing explanations (for science) and designing solutions (for engineering)** **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.** **Practice 8. Obtaining, evaluating, and communicating information** **Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.** **NGSS: Crosscutting Concepts**		

Unit	Standards	Content	Skills
	NGSS: 9-12 **Crosscutting Statements** **1. Patterns – Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.** **2. Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.** **7. Stability and Change – For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.** **Connections to the Nature of Science: Most Closely Associated with Crosscutting Concepts** **Science is a Human Endeavor** **NGSS: Disciplinary Core Ideas** **NGSS: 9-12** **PS3: Energy** **PS3.A: Definitions of Energy** 		

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Forces	**CCSS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12** **CCSS: Grades 11-12** **Reading: Science & Technical Subjects** **Key Ideas and Details** **1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.** **2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.** **Craft and Structure** **4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.** **Integration of Knowledge and Ideas** **7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.** **8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.** **9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.** **Writing** **Text Types and Purposes** **1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.** **2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.** **Production and Distribution of Writing** **4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.**	• Newton's Laws of motion • Forces and Motion	Students will be able to: • Recognize and state the definition of a force • Differentiate between contact and field forces • Calculate the force on an object using Newton's Laws of motion • Construct force models of real world situations

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	6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. **CCSS: Mathematics** **CCSS: HS: Num/Quantity** **Quantities** **HSN-Q.A. Reason quantitatively and use units to solve problems.** **Mathematical Practice** **MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.** **CCSS: HS: Algebra** **Seeing Structure in Expressions** **HSA-SSE.A. Interpret the structure of expressions.** **HSA-SSE.B. Write expressions in equivalent forms to solve problems.** **Creating Equations** **HSA-CED.A. Create equations that describe numbers or relationships.** **Reasoning with Equations & Inequalities** **HSA-REI.A. Understand solving equations as a process of reasoning and explain the reasoning.** **HSA-REI.B. Solve equations and inequalities in one variable.** **HSA-REI.D. Represent and solve equations and inequalities graphically.** **Mathematical Practice** **MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.** **CCSS: HS: Functions**		

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	Interpreting Functions **HSF-IF.B. Interpret functions that arise in applications in terms of the context.** **HSF-IF.C. Analyze functions using different representations.** **Building Functions** **HSF-BF.A. Build a function that models a relationship between two quantities.** **Mathematical Practice** **MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.** **NGSS: Science and Engineering Practices** **NGSS: 9-12** **Practice 1. Asking questions (for science) and defining problems (for engineering)** **Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.** **Practice 2. Developing and using models** **Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.** **Practice 3. Planning and carrying out investigations** **Planning and carrying out investigations 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.** **Practice 4. Analyzing and interpreting data** **Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis,**		

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	the comparison of data sets for consistency, and the use of models to generate and analyze data. **Practice 5. Using mathematics and computational thinking** **Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including 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.** **Practice 6. Constructing explanations (for science) and designing solutions (for engineering)** **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.** **Practice 8. Obtaining, evaluating, and communicating information** **Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.** **NGSS: Disciplinary Core Ideas** **NGSS: 9-12** **PS2: Motion and Stability: Forces and Interactions** **PS2.A: Forces and Motion** **PS2.B: Types of Interactions** **PS3: Energy** **PS3.A: Definitions of Energy** 		

Unit	Standards	Content	Skills
Static Electricity	**NGSS: Science and Engineering Practices** **NGSS: 9-12** **Practice 1. Asking questions (for science) and defining problems (for engineering)** **Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.** **Practice 2. Developing and using models** **Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.** **Practice 3. Planning and carrying out investigations** **Planning and carrying out investigations 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.** **Practice 4. Analyzing and interpreting data** **Analyzing data in 9–12 builds on K–8 experiences 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.** **Practice 5. Using mathematics and computational thinking** **Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including 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.** **Practice 6. Constructing explanations (for science) and designing solutions (for engineering)** **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**	• Positive and negative charges • Forces on other charges • Coulomb's Law. • Electrostatic forces • Electric field strength	The students will be able to: • Recognize that charge is a property of matter just like mass. • Distinguish between positive and negative charges. • Understand that charges exert forces on other charges. • Analyze the force between charge packets using Coulomb's Law. • Solve problems involving electrostatic forces. • Derive the electric field strength associated with various charge distributions

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	student-generated sources of evidence consistent with scientific ideas, principles, and theories. **Practice 8. Obtaining, evaluating, and communicating information** **Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.** **NGSS: Crosscutting Concepts** **NGSS: 9-12** **Crosscutting Statements** **2. Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.** **4. Systems and System Models – A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.** **5. Energy and Matter: Flows, Cycles, and Conservation – Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior.** **NGSS: Disciplinary Core Ideas** **NGSS: 9-12** **PS2: Motion and Stability: Forces and Interactions** **PS2.A: Forces and Motion** **PS2.B: Types of Interactions** **PS2.C: Stability and Instability in Physical Systems** Access the interactive version of the NGSS here		

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Current Electricity (Circuits)	**NGSS: Science and Engineering Practices** **NGSS: 9-12** **Practice 3. Planning and carrying out investigations** **Planning and carrying out investigations 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.** **Practice 4. Analyzing and interpreting data** **Analyzing data in 9–12 builds on K–8 experiences 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.** **Practice 5. Using mathematics and computational thinking** **Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including 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.** **Practice 6. Constructing explanations (for science) and designing solutions (for engineering)** **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.** **Practice 8. Obtaining, evaluating, and communicating information** **Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.** **NGSS: Crosscutting Concepts** **NGSS: 9-12**	• Currents • Positive and negative charge flow • Closed circuit • Ohm's law • Voltage, current and resistance • Series and parallel resistive circuits • Energy storage using capacitors	The students will be able to: • Recognize that current is the flow of positive charge. • Distinguish between current and negative charge flow. • Demonstrate understanding of the concept of closed circuit. • Understand that current flow requires a source of potential difference (battery, power supply, or generator). • Analyze the relationship between voltage (potential difference), current and resistance using Ohm's law. • solve problems involving voltage, current and resistance. • Employ techniques for analysis of series and parallel resistive circuits. • Analyze problems of energy storage using capacitors. • Employ techniques for analysis of series and parallel reactive circuits.

Unit	Standards	Content	Skills
	Crosscutting Statements **2. Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.** **4. Systems and System Models – A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.** **5. Energy and Matter: Flows, Cycles, and Conservation – Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior.** **7. Stability and Change – For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.** **Connections to the Nature of Science: Most Closely Associated with Crosscutting Concepts** **Science is a Human Endeavor** **NGSS: Disciplinary Core Ideas** **NGSS: 9-12** **PS2: Motion and Stability: Forces and Interactions** **PS2.B: Types of Interactions** **PS2.C: Stability and Instability in Physical Systems** **PS3: Energy** **PS3.B: Conservation of Energy and Energy Transfer** **PS3.C: Relationship Between Energy and Forces** Access the interactive version of the NGSS here		

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