PHYSICS		
HS-PS2-5: Motion and Stability: Forces and Interactions		
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.		
Clarification Statement: N/A		
Assessment Boundary: Assessment is limited to designing and conducting investigations with provided materials and tools.		
Evidence Statements: HS-PS2-5		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
Planning and Carrying Out Investigations 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. 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.	**PS2.B: Types of Interactions** 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. 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. **PS3.A: Definitions of Energy** "Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary)	**Cause and Effect** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
Connections to other DCIs in this grade-band: HS.PS3.A ; HS.PS4.B ; HS.ESS2.A		
Articulation of DCIs across grade-bands: MS.PS1.A ; MS.PS2.B ; MS.ESS1.B		
NJSLS- ELA: WHST.11-12.7, WHST.11-12.8, WHST.11-12.9		
NJSLS- Math: HSN.Q.A.1, HSN.Q.A.2, HSN.Q.A.3		

5E Model	
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.	
Engage Anticipatory Set	Understanding Electromagnetic Induction https://www.youtube.com/watch?v=tC6E9J925pY DC Motor: How it Works https://www.youtube.com/watch?v=LAtPHANEfQo
	Faraday Law and Electromagnet Lab Using this simulation, students will predict how the current will change when the conditions are varied. They will then design an experiment to determine how the size and direction of the induced current will change when the conditions are varied. Collect data, make observations and record your information in a table. https://phet.colorado.edu/en/contributions/view/2827

Exploration Student Inquiry	Magnetic Field Investigation In this lab you will investigate the properties of magnetic fields around a bar magnet. Lab Worksheet: https://phet.colorado.edu/services/download-servlet?filename=%2Factivities%2F3903%2FPhET_NGSS+Fields+2+Student+Sheet+-+Understand+and+Draw.pdf Simulation: https://phet.colorado.edu/en/simulation/electric-hockey Magnetism and Electricity Lab In this activity, students will be charged with building a better electromagnet. http://hendrix2.uoregon.edu/~dlivelyb/phys101/lab7_s07.pdf
Explanation **Concepts and Practices**	In these lessons Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): PS2.B: Types of Interactions 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. 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. PS3.A: Definitions of Energy "Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary)
Elaboration Extension Activity	Explaining Electrical Conductivity in Neurons Neurons are specialized to conduct electrical impulses using varied ion concentrations. https://www.youtube.com/watch?v=bS_N-nMiqnM How transformers work
Evaluation Assessment Tasks	Assessment Task A: Faraday Law and Electromagnet Lab Students will be assessed on their experimental design. Assessment Task B: Magnetism and Electricity Lab Students will be assessed on the effectiveness of the electromagnet that they improve.