Honors Physics - Unit 9 - Magnetism

Unit Focus

In this unit, students learn the relationship between electricity and magnetism, by exploring the impact of moving electrons has on both. In this highly interactive and lab based unit, students apply fundamentals of physics to experience how motors, generators, speakers, compasses and other real-world devices function. Students will have the opportunity to fabricate devices that take advantage of forces caused by changing magnetic fields. Students will also explore how the earth's magnetic field affects life on this big beautiful blue marble hurling through space at 67,000 mph around the sun in a solar system hurling 514,000 mph around the galaxy.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science
High School Physical Sciences: 9 - 12

- 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. *HS-PS2-5*

Next Generation Science Standards (DCI)
Science: 11

- 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. *PS2.9.B3*

Madison Public Schools Profile of a Graduate
Critical Thinking

- Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

Transfer

T1 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.

Meaning

Understanding(s)

U1 Energy that is stored in an electric, magnetic, or gravitational field depends upon the position of the objects in the field.
U2 While energy within a system is continually changing forms, and being transferred, the total energy of the system is conserved.

Essential Question(s)

Q1 Where does the energy of a system come from? How does it change? Where does it go?
Q2 How can position of an object in a field affect the amount of energy it has stored?

Acquisition of Knowledge and Skill

Knowledge

K1 Students will understand what is needed to produce a magnetic field. They will be able to describe what produces magnetic fields in permanent magnets and electromagnets.
K2 Students will understand that the earth is magnetic. They will be able to describe what produces earth's magnetic field. Students will be able to differentiate between earth's geographic poles and its magnetic poles.
K3 Students will understand that all permanent magnets have two poles – north and south. If a permanent magnet is divided, the resulting smaller magnets still have two poles.

Skill(s)

S1 Students will be able to draw magnetic field lines around permanent magnets and electromagnets.
S2 Students will be able to use a right-hand-rule to determine the magnetic field around a wire, a loop of wire or many loops (solenoid) of wire.
S3 Students will be able to determine the direction of the magnetic force on a current carrying wire in an existing magnetic field OR a moving charge in an existing magnetic field. Students will be able to explain what conditions are necessary in order for this force to be a

Stage 1: Desired Results - Key Understandings		
	K4 Students will understand how a compass works and how it can be used to determine the magnetic field around any magnet. **K5** Students will understand that when two magnets interact magnetic forces are created. They will understand that this force is directly related to the strength of the magnetic fields. **K6** Students will understand that moving charges (currents) create magnetic fields; **K7** Students will understand changing magnetic fields can create moving charges	maximum and what conditions are necessary for this force to be non-existent. **S4** Students will be able to determine the magnitude of the magnetic force on a wire or a moving charge in an existing magnetic field. **S5** Students will be able to determine the radius of the circular path taken by a charge moving perpendicular to an existing magnetic field. They should be able to work with magnetic force acting as a centripetal force. **S6** Students will be able to determine the magnitude and direction of magnetic force on different segments of a wire in a magnetic field. They will be able to calculate the acceleration of the wire and be able to include FM in Fnet calculations. **S7** Students will be able to calculate the voltage and current in step-up or step-down transformers