Marietta City Schools

District Unit Planner

Everything on the unit planner must be included on the unit curriculum approval statement.

Honors Science 8

Unit title	*Non-Contact Forces (Gravitational, Electrical, Magnetic)*	**MYP year**	*3*	**Unit duration (hrs)**	*20 Hours*

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): *What will students learn?*

GSE Standards

Standards

S8P5. Obtain, evaluate, and communicate information about gravity, electricity, and magnetism as major forces acting in nature.
a. Construct an argument using evidence to support the claim that fields (i.e., magnetic, gravitational, and electric) exist between objects exerting forces on each other even when the objects are not in contact.
b. Plan and carry out investigations to demonstrate the distribution of charge in conductors and insulators. *(Clarification statement:* Include conduction, induction, friction*)*
c. Plan and carry out investigations to identify the factors (e.g., distance between objects, magnetic force produced by an electromagnet with varying number of wire turns, varying number or size of dry cells, and varying size of iron core) that affect the strength of electric and magnetic forces. *(Clarification statement:* Including, but not limited to, generators or motors.)

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)
In fifth grade students:
S5P2. Obtain, evaluate, and communicate information to investigate electricity.
a. Obtain and combine information from multiple sources to explain the difference between naturally occurring electricity (static) and human-harnessed electricity.
c. Plan and carry out investigations on common materials to determine if they are insulators or conductors of electricity.

S5P3. Obtain, evaluate, and communicate information about magnetism and its relationship to electricity.
a. Construct an argument based on experimental evidence to communicate the differences in function and purpose of an electromagnet and a magnet. (*Clarification statement*: Function is limited to understanding temporary and permanent magnetism.)
b. Plan and carry out an investigation to observe the interaction between a magnetic field and a magnetic object. (*Clarification statement:* The interaction should include placing materials of various types (wood, paper, glass, metal, and rocks) and thickness between the magnet and the magnetic object.)

Gifted Standards

S2C Use a variety of strategies for solving authentic, complex, real world problems through evaluative thinking and the engineering design processes.

S3B Develop critical thinking, inductive and deductive reasoning to analyze and evaluate logical reasoning within a variety of problems and dilemmas.

S6E Seek opportunities for self-growth through risk-taking, and curiosity in various situations.

Concepts/Skills to be Mastered by Students

- Forces (friction, gravitational, electrical, and magnetic)
- Force Fields
- Conductors and insulators

Key Vocabulary: (KNOWLEDGE & SKILLS)
Magnet, magnetic field, poles, magnetic force, non-contact force, push, pull, attract, repel, potential energy, kinetic energy, electric field, electric force, static electricity, charge, transfer, conduction, induction, friction, positive, negative

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
How does matter and energy interact within the universe?

Unit Phenomena (LEARNING PROCESS)
Aviation Phenomenon: How do magnetic, electrical, and gravitational fields support and/or impact aviation?
MagLev trains rarely touch the track and can hit speeds of hundreds of miles per hour. How do MagLev trains work?
Why do I sometimes receive a “shock” when touching a door knob?

CER: Students answer the phenomenon in a Claim-Evidence-Reasoning constructed response as a formative and summative assessment.

Capstone Connective Theme:
Magnetic, Electrical, and Gravitational Fields in Aviation

UN Sustainable Development Goals: Industry, Innovation, and Infrastructure

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)

- Students may or may not have viewed magnetic field lines prior to this unit. Therefore, students should have access to hands-on and simulation opportunities to explore magnetic fields and make field lines visible. Remember, magnetic field lines are a way of mapping and representing magnetic forces that are able to act on other objects at a distance.
- Students may have the misconceptions that all metals are attracted to magnets and that only magnets are capable of producing magnetic fields.
- Additional common alternative conceptions that students may hold are that magnetic force always attracts and that a magnetic force only acts on objects that are close together.
- Students may confuse the terms conduction, induction, and friction.
- Students may have difficulty determining an object’s charge as a result of conduction, induction, or friction.

Key concept	Related concept(s)	Global context
Relationships (MYP)	Interaction (MYP)	**Scientific and technical innovation**

Relationships are the connections and associations between properties, objects, people and ideas - including the human community's connections with the world in which we live. Any change in a relationship brings consequences.		How the world works: an inquiry into the natural world and its laws; the interaction between the natural world (physical and biological) and human societies; how humans use their understanding of scientific principles; the impact of scientific and technological advances on society and on the environment.

Statement of inquiry

Scientific and technical innovations allow us to understand the relationships between objects in magnetic, gravitational, and electric fields.

Inquiry questions

Factual

- What are some examples of non-contact forces?
- What is a magnetic force?
- What is a magnetic field?
- Where on a magnet is the force the strongest?
- What is an electric force?
- What is an electric field?
- What are three ways in which electrons can be transferred?
- What factors influence the strength of gravitational fields?

Conceptual

- How do magnetic, electric, and gravitational forces act on objects which are not in direct contact with one another?
- What "rules" can we establish for magnet behavior?
- How does the magnetic force change as the strength of the magnets, the distance the magnets are from one another, and the alignment of the magnets change?
- How do the ways in which electrons are transferred compare/contrast with one another?
- How do the ways in which electrons are transferred impact an object's charge and/or distribution of charge?
- How does varying the components of an electromagnet affect the strength of electric and magnetic forces?

Debatable

- What is the best design for an electromagnet?
- What is the best design for a MagLev train built to function at high speed?
- Which non-contact force has had the greatest impact in the field of Aviation?

MYP Objectives	Assessment Tasks

*What specific MYP **objectives** will be addressed during this unit?*	***Relationship** between summative assessment task(s) and statement of inquiry:*	*List of common formative and summative assessments.*
Science A: Knowing & Understanding I. describe scientific knowledge Iii. analyze information to make scientifically supported judgments Science B: I. describe a problem or question to be tested by a scientific investigation Science C: Processing & Evaluating Ii. interpret data and describe results using scientific reasoning Science D: Reflecting on the Impacts of Science Iii. apply scientific language effectively Design B: Developing Ideas Iv. develop accurate planning drawings/diagrams and outline requirements for the creation of the chosen solution Design C: Creating the Solution V. present the solution as a whole Design D:	SOI: Scientific and technical innovations allow us to understand the relationships between objects in magnetic, gravitational, and electrical fields. The SOI tasks students with understanding the relationships between magnetic and electric fields, in addition to how innovations in science and technology have allowed us to explore these fields and the forces they generate. Through the assessment tasks, students are exploring the properties of these fields and the forces they exert through both hands-on investigations and simulations. They also investigate real-world applications of magnetic and electric fields/forces, with the ultimate goal of engaging in a design challenge in which they must demonstrate their understanding by creating the strongest electromagnet possible under certain design constraints. Based on their understanding of magnetic and electric field behaviors, students observe and predict magnet behavior, as well as the transfer of charges during the processes of conduction, induction, and friction.	**Formative Assessment(s):** Non-Contact Forces CFA **Summative Assessment(s):** Non-Contact Forces Unit Assessment Paper I

Ii. explain the success of the solution against the design specification Iii. describe how the solution could be improved		
Approaches to learning (ATL)		
Category: Thinking **Cluster:** Critical Thinking **Skill Indicator:** Make logical, reasonable judgments and create arguments to support them.		

Learning Experiences Add additional rows below as needed.		
Objective or Content		**Personalized Learning and Differentiation**
S8P5. Obtain, evaluate, and communicate information about gravity, electricity, and magnetism as major forces acting in nature. **a.** Construct an argument using evidence to support the claim that fields (i.e., magnetic, gravitational, and electric) exist between objects exerting forces on each other even when the objects are not in contact.	• Lab: Exploring Magnets and Magnetic Fields (Science B,C) • PhET: Gravity Force Lab: Basics • Graphing Gravity	• Capstone Connections • Discovery Education High School Science Techbook • NGSS Case Studies for Differentiated Learners • Next Generation Science Standards: "All Standards, All Students" • Extensions – Enrichment Tasks/Projects Task-Specific Differentiation • Scaffolding • Extended Learning • Sentence Starters • Leveled Tasks • Mode/Method of Presentation • Type of Product
S8P5. Obtain, evaluate, and communicate information about gravity, electricity, and magnetism as major forces acting in nature. **b.** Plan and carry out investigations to demonstrate the distribution of charge in conductors and insulators. *(Clarification statement:* Include conduction, induction, friction*)*	• Lab: Investigating Electrostatics (Science B,C) • PhET: John Travoltage	
S8P5. Obtain, evaluate, and communicate information about gravity, electricity, and magnetism as major forces acting in nature.	• Design an Electromagnet (Design B-D)	

c. Plan and carry out investigations to identify the factors (e.g., distance between objects, magnetic force produced by an electromagnet with varying number of wire turns, varying number or size of dry cells, and varying size of iron core) that affect the strength of electric and magnetic forces. *(Clarification statement:* Including, but not limited to, generators or motors.)		

Content Resources

Georgia Grade 8 Science GaDOE Instructional Segment: Forces

Discovery Education Grade 8 Science Techbook
- Concept 5.1: Static Changes
- Concept 5.2: Electricity and Magnetism Relationship

Discovery Education Physics Science Techbook

Discovery Education: Boeing Partnership

PhET:
- Gravity Force Lab: Basics
- John Travoltage

Capstone Connections

Research: Investigating the Impact of Non-Contact Forces in Flight (Science A,D)

Capstone Action Plan Proposal (Sections E-G)

Capstone Action Plan Feedback

Capstone Product Work