Grade 7 Science – Course 2
Unit # 3 – Physical Science
Topic 9 Electricity and Magnetism – 18 Days

Unit Overview - Students will explore Physical Science topics of waves, electricity and magnetism, and information technologies. Students will examine and model different wave properties and investigate ways that waves can react when they strike materials and the interaction between waves. Students will learn about electrical forces and magnetic forces by identifying evidence that electrical force is exerted by invisible fields. Students will be able to differentiate between static electricity and current. Students will then ascertain evidence that magnetic force is exerted by invisible fields and pinpoint evidence of a planetary magnetic field around Earth. Students then will distinguish between three components of electric circuits and describe relationships among voltage, current, and resistance. Finally, students will describe possible ways information signals can be sent and encoded.

Topic Essential Question: What factors affect the strength of electric and magnetic forces?

Lessons

- Topic Launch/Quest Kickoff
- Lesson 1 Electric Force
- Lesson 2 Magnetic Force
- Lesson 3 Electromagnetic Force
- Lesson 4 Electric and Magnetic Interactions
- Topic Close – Assessment, Quest Findings

NYSSLS Performance Expectations

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]

MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations. Emphasis should be on using arrows to represent the directions of forces.] [Assessment Boundary: Assessment is limited to electric and magnetic fields and is limited to qualitative evidence for the existence of fields.]

MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]

MS-PS3-6. Make observations to provide evidence that energy can be transferred by electric currents. [Clarification Statement: Emphasis should be on arrangements of circuit components in series and parallel circuits.] [Assessment Boundary: Assessment will be limited to qualitative analysis and reasoning.]

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Topic Opener **PE:** MS-PS2.3; MS-PS2-5; MS-PS3-2 **SEP:** Developing and Using Models; Planning and Carrying Out Investigations **DCI:** **PS 2.B –** Types of Interactions ● Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3) ● Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS-PS2-5) **PS 3.C-** Relationships Between Energy and Forces ● When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2) **CCC –** Cause and Effect; Systems and System Models	**Savvas** **Highlighted labs are important to the understanding of the instructional concepts in this lesson and must be completed during Science instructional time.** ● Topic Readiness Test ● *u*Connect Lab – Magnetic Poles ● Quest Kickoff Video – How can you lift an object without making contact?

Lesson 1 –Electric Force

PE:MS-PS2-5; MS-PS3-2; MS-PS3-6

SEP: Developing and Using Models; Planning and Carrying Out Investigations

DCI:

PS2.B – Types if Interactions

- Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS-PS2-5)

PS3.A – Definitions of Energy

- A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)

PS3.B – Conservation of Energy and Energy Transfer

- (NYSED) An electric circuit is a closed path in which an electric current can exist. (MS-PS3-6)

PS3.C – Relationship Between Energy and Forces

- When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)

CCC: Cause and Effect; Systems and System Models;

Savvas

Guiding Objectives:

- Students will identify and describe evidence that: Two objects can exert electric forces on each other even though they are not in contact; electric force acting at a distance can be explained by fields that extend through space.
- Students will use system models to: Describe how potential energy is stored in a system; identify and describe how the potential energy of a system changes as the relative position of two objects changes.
- Students will identify cause-and-effect relationships to explain how static electricity is different from current.

Literacy Connection

- Integrate with Visuals

Vocabulary

- electron
- electric force
- static electricity
- electric current
- conductor
- electric field

Academic Vocabulary

- charge
- neutral

Connect - TE/SB p.454

- Connect It!
- Quest Connection
- Inquiry Warm-Up Lab: Uncanny Attractions

Investigate - TE/SB pp.455-461

- *u*Investigate Lab – Detecting Charges*
- Video – Electric Force
- Interactivity – Theremin
- Interactivity – Electric Current
- Question It! (p.457)
- Literacy Connection (p.458)
- Reading Checks (pp.455; 459; 461)

Synthesize - TE/SB pp. 461-462

- Interactivity – Charged Interactions
- Quest Check-In Interactivity – Apply Electrical Forces
- Quest Check-In

Demonstrate – TE/SB p.462

- Lesson 1 Check
- Lesson Quiz 1

*Denotes accompanying lab video

Lesson 2 – Magnetic Force

PE: MS-PS2-5; MS-PS3-2

SEP: Planning and Carrying Out Investigations

DCI:

PS2.B – Types if Interactions

- Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS-PS2-5)

PS3.A – Definitions of Energy

- A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)

PS3.C – Relationship Between Energy and Forces

- When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)

CCC: Cause and Effect; Systems and System Models

Savvas

Guiding Objectives:

- Students will use a model to explore how changing the arrangement of objects interacting at a distance: Changes the magnetic force between the objects; changes the potential energy between the objects.
- Students will evaluate an experimental design to detect and describe a magnetic field.

Literacy Connection

- Verify

Vocabulary

- magnet
- magnetism
- magnetic force
- magnetic pole
- magnetic field

Academic Vocabulary

- interaction

Connect - TE/SB p. 464

- Connect It!
- Quest Connection
- Write: Magnets Are Closer Than You Think

Investigate - TE/SB pp. 465-469

- Video – Magnetic Force
- *ul*Investigate Lab – Detecting Fake Coins
- Interactivity – Interaction of Magnetic Fields
- Virtual Lab – Get Your Bearings
- Model It! (p.469)
- Reading Check (p.468)

Synthesize - TE/SB pp. 470-471

- Interactivity – Modeling Magnetic Forces
- Quest Check-In Lab – Tracking Levitation
- Reading Check (p.470)
- Literacy Connection (p.470)
- Quest Check-In

Demonstrate – TE/SB p.471

- Lesson 2 Check
- Lesson 2 Quiz

<u>Lesson 3 – Electromagnetic Force</u> **PE:** MS-PS2-3 **SEP:** Asking Questions and Defining Problems **DCI:** **PS2.B –** Types if Interactions ● Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3) **CCC**: Cause and Effect	**Savvas** **Guiding Objectives:** ● Students will identify and explain: How electricity relates to magnetism; the properties of solenoids and electromagnets. ● Students will use visuals to describe the magnetic field produced by a current. ● Students will analyze data to determine how an increase in the number of coils or current affects magnetic field strength. **Literacy Connection** ● Cite Textual Evidence **Vocabulary** ● electromagnetism ● solenoid ● electromagnet **Academic Vocabulary** ● produce **Connect -** TE/SB p.472 ● Connect It! ● Quest Connection ● Class Discussion – A Subtle Relationship **Investigate -** TE/SB pp. 473 - 477 ● *u*Investigate Lab – Electric Current and Magnetism* ● Video – Electric Current and Magnetism ● Interactivity – Electricity and Magnetism ● Interactivity – Electromagnetism ● Literacy Connection (p.473) ● Reading Check (pp.474; 475; 477) ● Model It (p.475) ● Math Toolbox (p.476) **Synthesize -** TE/SB pp. 477-478 ● Interactivity – Electromagnetic Evidence ● Quest Check-In Lab – Building an Electromagnet ● Literacy Connection (p.420) **Demonstrate –** TE/SB p.478 ● Lesson 3 Check ● Lesson 3 Quiz *Denotes accompanying lab video

Lesson 4 – Electric and Magnetic Interactions **PE:** MS-PS2-3 **SEP:** Asking Questions and Defining Problems **DCI:** **PS2.B –** Types of Interactions ● Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3) **CCC:** Cause and Effect	**Savvas** **Guiding Objectives:** ● Students will use textual evidence to explain: How current can be produced in a conductor; how generators and transformers work. ● Students will analyze diagrams in order to explain how magnetic fields affect moving charges. ● Students will analyze proportional relationships to calculate the voltage of a primary coil with one loop compared to a secondary coil with eight loops, knowing the voltage of the secondary coil. **Literacy Connection** ● Draw Evidence **Vocabulary** ● galvanometer ● electric motor ● electromagnetic induction ● generator ● transformer **Academic Vocabulary** ● source **Connect -** TE/SB p.480 ● Connect It! ● Quest Connection ● Inquiry Warm-Up Lab – How Generators Work **Investigate -** TE/SB pp. 481-487; 488 ● *u*Investigate Lab – Electric and Magnetic Motion ● Video – Electric and Magnetic Interaction ● Interactivity – Electric Motors ● Interactivity – Generators ● Reading Check (pp. 483; 485; 486; 488) ● Question It! (p.486) ● Literacy Connection (p.484) ● Math Toolbox (p.488) **Synthesize -** TE/SB pp. 487; 489 ● Interactivity – Electricity, Magnets, and Motion ● Quest Check-In Lab – Electrifying Levitation ● Quest Check-In **Demonstrate –** TE/SB p.489 ● Lesson 4 Check ● Lesson 4 Quiz

Topic Close

- Topic 9 Assessment and Remediation TE/SB pp. 492-495
- Quest Finding and Reflection TE/SB p. 495

Topic 9 Enrichment

Topic 9 - Lesson 1 Enrichment

- Enrichment – Surge Protectors
- Extraordinary Science – Bumblebees and Electric Flowers (p.463)

Topic 9- Lesson 2 Enrichment

- Enrichment – Magnetic Fields

Topic 9 - Lesson 3 Enrichment

- Enrichment – Electromagnetic Forces
- Engineering Design Notebook – Build a Recycling Center Electromagnetic (p.497)

Topic 9 - Lesson 4 Enrichment

- Enrichment – Examining a Motor
- Case Study – The X-57 Maxwell

English Language Learners (ELL) Enhancements

To access hyperlinked material, you must be logged into your BPS Google Drive

Listening

- **Cross- Linguistic Practices:** Gives students opportunities to make connections between what they hear and their home language (For example, allow students to listen to a passage and identify cognates).
- **Activating Prior Knowledge** Activating prior knowledge means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content**.**
- **Visuals** - GIFs, pictures- will assist students in understanding what they are listening to. Use **visual thinking strategies** to set the lens for learning.
- Video to review or introduce a topic – use **closed captioning** to help students see the words and pronunciations while they listen to the content.
- **Word stretching / Vowel stretching** when instructing allows student to listen closely to the pronunciation of the word.
- **Performance Level Descriptors** this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of listening. Scroll for grade 7.

Speaking

- **Sentence Stems/Frames** - to begin a sentence - such as *Evolution is…* or *I think that evolution is…*
- **Academic Conversation Starters:** Have a visual of a list of academic sentence starters that students can refer to in a discussion.
- **Choral Reading** - To build fluency, self-confidence and motivation with reading/speaking.
- Create **movement** to go with the word. Movement can be a motivating factor, as well as a kinesthetic tool for conceptualizing the rhythm and flow of fluent reading while triggering brain function for optimal learning.
- **Performance Level Descriptors** This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of speaking. Scroll for grade 7.

<table>
<tr><td rowspan="3"></td><td><u>Reading</u>
● Supplementary Text to help reinforce concepts.
● <u>Visual Aids</u> - Pictures or models to support vocabulary words and concepts
● Video to review or introduce a topic - use <u>closed captioning</u> to help students read along while they listen to the content.
● <u>4 Square / Frayer models</u> to help students gain a deeper understanding of vocabulary.
● <u>Highlighting</u> important text to assist students in answering questions after the reading.
● <u>Chunking</u>-Break reading of text into chunks or paragraphs
● <u>Vocabulary Morphology</u>- Morphology relates to the segmenting of words into affixes (prefixes and suffixes) and roots or base words, and the origins of words. Understanding that words connected by meaning can be connected by spelling can be critical to expanding a student's vocabulary.
● <u>Performance Level Descriptors</u> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of reading. Scroll for grade 7.</td></tr>
<tr><td><u>Instructional Accommodations</u> (depending on the student's needs)
● Extended time for tests in class, projects and assignments
● Directions read. Broken down as necessary
● Model how to complete the activity in the lesson
● Oral simplification of directions or questions
● Translated version of test when available. Student may have both version English and native language version
● Use of <u>approved bilingual glossaries</u> from NYS in each subject</td></tr>
<tr><td>Special Education Modifications

Special Education students must have accommodations as per Individual Educational Plan (IEP)</td><td><u>Instructional</u>
● Pre-teach vocabulary
● Use picture vocabulary
● Scaffold Depth of Knowledge questions
● Provide copy of notes/notes in "cloze" form
● Use of Think, Pair, and Share strategy to help process information
● Scaffold written assignments with the use of graphic organizers
● Allow for multiple ways to respond (verbal, written, response board)
● Provide model of performance task
● Modify informational text to fit the needs of the students
● Provide a digital or paper interactive notebook
● Present complex tasks in multiple ways
● Provide mnemonic strategies for scientific concepts</td></tr>
<tr><td><u>Technology:</u>
● Audio reading of text
● Text to type functions
● Videos to clarify/visualize science concepts
● Record class lecture/discussions and make accessible to student
● Nearpod- interactive presentations of notes</td></tr>
<tr><td></td><td><u>In Class Assessments</u>
● Provide multiple options for projects
● Use of timer in class
● Break all complex tasks into chunks</td></tr>
</table>

Step Up to Writing Step Up to Writing Materials can be found in BPS Science K-12 Schoology Folder Grade 5 Resources Grade 5 SUTW materials	• Easy Two-Column Notes • Breaking Down Definitions • Paragraph Frame- What I Learned • **Performance Level Descriptors** this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of writing. Scroll for grade 7.
Culturally and Linguistically Responsive Teaching (CLRT) in the Science Classroom	• Materials, resources, and/or discussions address diverse cultural backgrounds and real-world applications • Artifacts (posters, charts, etc.) in the science classroom are representative of the cultures of the student population • All students are given an opportunity to engage in science discourse • Teacher demonstrates high expectations for all students