Unit: Electricity, Waves and Informational Transfer

Content Area: **Science**
Course(s): **Integrated Science 7**
Time Period: **2nd Marking Period**
Length: **14 Weeks**
Status: **Not Published**

Unit Overview

Students observe and investigate electric devices, sources of waves, and simple examples of energy transfer in order to construct explanations for the function and use of information transfer systems as a means to communicate information.

Transfer

Students will be able to independently use their learning to…

- Become better prepared for using knowledge of electricity, waves, and information transfer to understand the planning and use of a disaster relief system.
- Understand the dangers of electricity and use proper safety precautions.
- Investigate a career in electrical or design engineering as it applies to STEM careers.
- Understand how electricity in a home is dispersed.
- Explain how global communications systems rely on information technology designs which use wave properties to encode and transmit information.
- Describe how animal body systems use electrical impulses to send, respond to, and store information.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

- Electric current flows through a closed circuit which contains a source of electrical energy.
- Resistors and capacitors regulate current in an electric circuit.
- Circuit components of different electrical devices change electrical energy into thermal, kinetic, sound,

and light energy.
- Waves interact with matter in predictable ways which informs the engineering design process.
- Light and sound waves are used to encode, store, and transmit information in analog and digital formats.
- Animal communication and navigation systems rely on the transmission and reflection of sound waves.
- Touch screen technologies use electrical properties.
- Medical imaging technologies use electricity and waves.

Essential Questions

Students will keep considering...

- What is electricity and how is it measured?
- How can components in an electric circuit affect current and voltage?
- How is the transfer of thermal energy from electrical devies regulated?
- How do components in an electrical system transform electrical energy into kinetic energy?
- How can we use models to understand wave properties?
- How do waves behave when they interact with matter?
- How do we use waves to encode and transmit information?
- How can electricity and waves be used to communicate information from one place to another?
- How are the properties of electromagnetic waves useful for human communication, navigation, and medical diagnoses?
- How are electrical components used to design touch screen devices?

Application of Knowledge and Skill

Students will know...

Students will know...

- The definition of energy and distinguish it from matter
- How batteries supply energy to circuits
- The difference between voltage and current
- How wires, capacitors, and resistors affect voltage and current
- The difference between thermal energy, temperature, and heat
- Energy is conserved as it is transformed from one form to another
- Models can be used to understand wave properties
- Types, properties, and behavior of different types of waves
- Waves properties and behavior changes when interacting with matter
- Ohm's Law

- The main components of communications systems include encoders, transmitters, and receivers
- Encoders are devices which translate information into waves
- Transmitters are devices which send waves from place to place
- Receivers are devices which convert information in waves to produce sound and light displays

Students will be skilled at...

Students will be skilled at...

- Constructing explanations, making predictions, planning and carrying out investigations to determine the effects of resistance.
- Test ideas about how capacitors affect current and voltage in a circuit.
- Drawing conclusions about how energy is conserved as it is transformed.
- Construct scientific arguments from evidence as they use their data and observations.
- Use models to make predictions.

Content Specific Vocabulary

Action potential

Ammeter

Ampere

Amplitude

Analog

Axon

Battery

Capacitive touch screen

Capacitor

Charging

Chemical energy

Circuit

Color

Compound battery

Compression

Conductor

Convex

Cortex

Crest

Current

Decibel

Dendrite

Dielectric

Digital

Discharging

Echolocation

Electrical energy

Electricity

Electrode

Electrolyte

Electromagnet

Electromagnetic radiation

Electromagnetic spectrum

Electromagnetic wave

Energy Transfer

Energy transformation

Filament

Frequency

Gauge

Global positioning system

Global seismographic network

Heat

Heliograph

Hertz

Incandescent

Incident ray

Kinetic energy

Law of conservation of Energy

Lens

Longitudinal wave

Mechanical wave

Membrane potential

Myelin

Nervous system

Neuron

Nonconductor

Ohm

Ohm’s Law

Opaque

Optical fiber

Parallel

Phonation

Photon

Pitch

Pole

Power

Quantum

Rarefaction

Reflect

Reflected ray

Reflecting telescope

Refraction

Resistive touch screen

Resistor

Resting state

Satellite

Seismic activity

Semaphore

Sensor

Sensory receptor

Series

Static electricity

Stimulus

Stylus

Supra laryngeal vocal tract

Telegraph

Temperature

Terminal

Thalamus

Thermal energy

Threshold

Translucent

Transmit

Transparent

Transverse Wave

Trough

Volt

Voltage

Voltmeter

Watts

Wave

Wavelength

Cognitive Vocabulary

Constraint

Criterion

Design

Diagnostic protocol

Disperse

Hypothesis

Interference

Medium

Modify

Optimize

Neutral

Prediction

Prototype

Schematic

Learning Goal 1

SCI.MS-PS2-3 - [*Performance Expectation*] - Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.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.
SCI.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Target 1 (lesson 1)

- Understand how to use electricity safely.
- Use models to understand and explain electric current.
- Collect and analyze data on current and voltage.
- Use evidence from observations to explain how voltage and current can vary.

Target 2 (lesson 2)

- Develop and use models to explain how resistors and capacitors affect current and voltage in an electrical circuit.
- Apply understanding of resistance to extension cord safety.
- Measure resistance of components of a circuit.
- Understand the mathematical relationship between voltage, current, and resistance to calculate power.

Target 3 (lesson 12)

- Distinguish capacitive touch screens from resistive touch screens.

Learning Goal 2

SCI.MS-PS3-3 - [*Performance Expectation*] - Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

SCI.MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
SCI.MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
SCI.MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
SCI.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.
SCI.MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

Target 1 (lesson 3)

- Understand the differences between thermal energy, temperature, and heat.
- Distinguish between energy transformation and energy transfer.
- Identify energy transformations which occur in electric devices.
- Design and build a device that either maximizes or minimizes the transfer of thermal energy to the surroundings.
- Compare and contrast different types of lightbulbs and analyze appropriate uses for them.
- Explain how energy transformations in a circuit obey the Law of Conservation of Energy.

Learning Goal 3

SCI.MS-PS3-5 - [*Performance Expectation*] - Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

SCI.MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Target 1 (lesson 4)

- Use their observations to conclude a relationship between electricity and magnetism.
- Describe factors which affect the strength of an electromagnet.
- Build an electromagnet, observe transformation of electrical energy into kinetic energy in a motor.
- Construct an argument based on evidence about the source of kinetic energy in a motor.

Learning Goal 4

SCI.MS-PS4-1 - [*Performance Expectation*] - Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

SCI.MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

Target 1 (lesson 5)

- Understand and describe wave properties quantitatively and qualitatively.
- Identify the relationships between frequency and wavelength in a longitudinal wave.
- Identify the relationships between frequency, wavelength, amplitude and energy in a transverse wave.
- Compare and contrast longitudinal and transverse waves.

Target 2 (lesson 8)

- Understand and explain how wave amplitude and frequency can be used to encode information.

Target 3 (lesson 11)

- Describe how medical technologies use electricity and waves to image the body.

Learning Goal 5

SCI.MS-PS4-2 - [*Performance Expectation*] - Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials

SCI.MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

Target 1 (lesson 6)

- Understand and explain how wave behavior is altered as it interacts with matter.

Target 2 (lesson 8)

- Understand and explain how wave amplitude and frequency can be used to encode information.

Target 3 (lesson 10)

- Explain how some living organisms have auditory and visual communication systems which use wave technology.

Target 4 (lesson 11)

- Describe how medical technologies use electricity and waves to image the body.

Learning Goal 6

SCI.MS-PS4-3 - [*Performance Expectation*] - Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

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Target 1 (lesson 7)

- Understand and explain how light waves can transmit information through various media.
- Understand the difference between analog and digital signals.

Learning Goal 7

SCI.MS-LS1-8 - [*Performance Expectation*] - Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

SCI.MS-LS1-8	Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

Target 1 (lesson 9)

Understand and explain how neurons use voltage changes to transmit information.

Summative Assessment

All assessments are differentiated and aligned to the science standards and curriculum. Alternate assessment may include projects or presentations, or a common paper/pencil assessment, or both.

Common summative assessments, which include inquiry reflection are developed based on corresponding STC Kit and are computer based.

Common Assessment administered through LinkIt.

21st Century Life and Careers

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their

	organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

Formative Assessment and Performance Opportunities

- analogy prompt
- constructed response
- exit card
- group work
- interactive notebook entry
- lab reflection and conclusion
- misconception check
- oral presentations
- performance assessment
- science notebook
- student conference
- student response system
- student sheets
- teacher designed homework
- teacher observation
- think-pair-share
- Unit investigation inquiry

Differentiation

- collaborative flexible grouping
- foldable study guides
- graphic organizers
- guided reading
- homework choice
- informational text (leveled)
- jigsaw
- learning stations
- leveled rubrics
- quizlet for vocabulary review
- student notebook entry
- think-pair-share-
- tiered assignments

Enrichment

- Cross-curricular extension activity
- Current Events Student Presentations
- Google Hangouts
- Guest Speakers

Unit Resources

Carolina STC Kits	Google Hangouts with Meteorologists
Carolina Curriculum Online	Guest Speakers
Supplemental Textbooks	Videos-Bill Nye series
Digital resources	Interactive science notebook
Digital interactives	review games
Blackline Masters	Chromebook
Digital Camera	Student Response Systems
Document Camera	
Flash Drives	
Flip Camera	

Global Positioning Handhelds	