MOHAWK
Local School District
Preparing today's students for tomorrow's challenges

# Mohawk Local Schools Physics - SCIENCE

## Quarter 4 Curriculum Guide

### Guiding Principles of the Scientific Inquiry/Learning Cycle:

<u>Evaluate….Engage…Explore…Explain…Extend…Evaluate</u>

Identify ask valid and testable questions
Research books, other resources to gather known information
Plan and Investigate
Use appropriate mathematics, technology tools to gather, interpret data.
Organize, evaluate, interpret observations, measurements, other data
Use evidence, scientific knowledge to develop explanations
Communicate results with graphs charts, tables

Critical Areas of Focus Being Addressed:

- Waves
- Electricity and Magnetism
- Scientific Inquiry

| Content Statements Addressed and Whether they are Knowledge, Reasoning, Performance Skill, or Product: (DOK1) (DOK2) (DOK3) (DOK4) | Underpinning Targets Corresponding with Standards and Whether they are Knowledge, Reasoning, Performance Skill, or Product: "I can…..", "Students Will Be Able To……." |
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| Waves Properties (DOK 2) | • Apply the law of conservation of energy to the measureable properties of waves, such as wavelength, |

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| | frequency, amplitude, and speed (R)<br>• Describe a standing wave as a self-interfering wave (R)<br>• Predict how light waves are absorbed as thermal energy, are transmitted, or are reflected when striking transparent, translucent, and opaque objects while the total amount of energy is conserved (R)<br>• Describe refraction as a function of the change in the speed of light as it travels from one medium into another (R) |
| Light Phenomena (DOK 2) | • Describe light as a bundle of energy called a photon (K)<br>• Relate the energy in a photon as a function of the frequency (R)<br>• Describe the duality of light, such that light behaves as both a wave and a particle depending on what phenomena is being explained (R)<br>• Explain radiant energy as an electromagnetic wave that spreads out in all directions from a source (R)<br>• Explain how the different parts of the electromagnetic spectrum, including visible light, correspond to different radiant energies (R)<br>• Explain how reflection and absorption of white light on a pigment results in the perception of color (R)<br>• Describe the law of reflection and apply the law of conservation of energy applied to the measureable properties of waves, such as wavelength, frequency, amplitude, and speed (R)<br>• Apply the law of reflection to predict wave behaviors (R)<br>• Construct a ray diagram that shows reflected light as it passes through a plane mirror (R)<br>• Solve for the index of refraction using the speed of a wave in a particular medium and the speed of light in a vacuum (R)<br>• Construct a ray diagram that shows reflected light as it |

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| | passes through converging and diverging lenses (R)<br>• Solve problems using Snell's law of refraction (R)<br>• Predict the locations of constructive and destructive interference as a function of wavelength, slit width, and spacing (R)<br>• Explain how light falling on two slits produces an interference pattern (R)<br>• Describe the cause of constructive and destructive interference in terms of the wave model of light (R)<br>• Describe the cause of diffraction patterns (R)<br>• Explain how a diffraction grating works (R)<br>• Measure and explain the amount of bending of a wave when it goes through an opening or around a barrier (diffraction) based on the wavelength and size of the opening or barrier (R) |
| Charging Objects (DOK 2) | • Use the law of conservation of electric charge to predict the net charge of a closed system (R)<br>• Define the law of conservation of charge (K)<br>• Trace the movement of electrons as a neutral object is charged either by friction, contact, or induction (R)<br>• Explain the difference between charging by friction, contact, and induction (R)<br>• Describe the behavior of charge distribution on an electrical conductor (spread out) and electrical insulator (localized) (R)<br>• Apply the particle model of matter to explain the interaction between a charged and a neutral object (R)<br>• Explain the attractive force resulting from a charged object coming in contact with a neutral metal conductor or a neutral insulator (R) |
| Coulomb's Law (DOK 2) | • Compare the electrical force (repulsive and attractive, tend to cancel each other) and the gravitational force (only attractive and accumulative) (R)<br>• Model the electrical force as the result of the distance |

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| | between point charges (R)<br>• Solve problems using Coulomb's law between two point charges, or three or more charges in a line if the vector sum is zero (R) |
| Electric Fields and Electric Potential Energy (DOK 2) | • Calculate the electric field strength of a charged object or a collection of charges (superposition principle) (R)<br>• Use electric field diagrams as a type of model used to show relative field strength (R)<br>• Identify that the electric field is always there even if the object is not interacting with anything else (K)<br>• Represent an electric field with arrows in a field diagram, including the fields of dipoles and capacitors (field lines are not required) (R)<br>• Explain the motion of charges (kinetic energy) in terms of work and a system's electric potential energy (R)<br>• Analyze the transference of electric potential energy into or out of a closed system when two charges are moved closer or farther apart (R)<br>• Recognize a single point charge does not have electrical potential energy, but systems of attracting and repelling charges do. (R) |
| DC Circuits (DOK 2) | • Explain that electric potential difference and electric fields move through a wire almost instantaneously upon the connection of a circuit, but the electrons themselves move only a few centimeters per hour in a current-carrying wire (R)<br>• Apply the law of conservation of charge to model the amount of current flowing in and out of a circuit junction (junction rule) (R)<br>• Apply the law of conservation of charge to model the potential differences across batteries and resistors (loop rule) (R)<br>• Calculate the potential difference across batteries and resistors (Ohm's law) (R) |

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| | • Determine the resistance by finding the slope on a graph of potential difference vs. Current (R)<br>• Identify whether two circuit elements are in series, parallel, or neither (K)<br>• Calculate the equivalent resistance for a circuit containing resistors in series and parallel (R)<br>• Design and construct simple ohmic resistive circuits using the loop rule and junction rule (R)<br>• Explain conceptually and calculate how current and potential difference are distributed differently among parallel and series circuit elements (R) |
| Magnetic Fields and Energy (DOK 2) | • Use the particle theory of matter to explain the difference between magnetic and non-magnetic materials (R)<br>• Explain how moving charges create magnetic fields (R)<br>• Use a compass to find the direction of a magnetic field at different points in space (R)<br>• Use magnetic field line diagrams to model relative field strength and magnetic field direction (R)<br>• Use magnetic fields to describe the concept of magnetic potential energy (R)<br>• Explain why only systems of attracting or repelling poles can have magnetic potential energy, and that a single magnetic pole does not have magnetic potential energy (R)<br>• Explain motions of magnetic objects in terms of work and the system's magnetic potential energy (R) |
| Electromagnetic Interactions (DOK 2) | • Explain that the electric and magnetic forces are two aspects of a single electromagnetic force (R)<br>• Describe the connection between moving charges and magnetic fields (R)<br>• Explain earth's magnetic field in terms of moving electric charges in the interior of the earth (R)<br>• Explain how a magnetic force acting on a moving |

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| | charged particle is perpendicular to both the magnetic field and the direction of the motion of the charged particle (third right-hand rule) (R)<br>• Identify that there is no magnetic force acting on a particle that is moving parallel to a magnetic field (K)<br>• Explain how a changing magnetic field induces an electric field (R)<br>• List the factors that determine the strength of an induced current in a wire by a magnetic field (strength of magnetic field, velocity of relative motion, number of loops in the wire) (K)<br>• Apply the concepts of electric and magnetic forces that demonstrate the conversion of mechanical energy to electric energy (generator) (R)<br>• Explain how a changing electric field induces a magnetic field (R)<br>• Describe the strength of the magnetic force induced by current in a wire (speed of a moving particle, magnitude of the charge, strength of the magnetic field, angle between velocity and magnetic field) (R)<br>• Apply the concept of electric and magnetic forces that demonstrate the conversion of electrical energy to mechanical energy (motor) (R)<br>• List evidence that supports the relationship between electric and magnetic fields (K)<br>• Explain the origin of electromagnetic waves by changing the motion of charges or by changing magnetic fields (R)<br>• Explain that electromagnetic waves travel at the speed of light (R)<br>• Construct a device that produces or receives electromagnetic waves (speaker, microphone, radio, TV) (R) |