MAPPING GRADE 4 SCIENCE INSTRUCTION

Concept: Force, Motion, and Energy
PWC Strand: Physical Science
CMS Unit Test: Motion
SOL Reporting Category: Force, Motion, Energy, Matter

PWC Objective: 4.4.1

The student will investigate and understand characteristics and interactions of moving objects. Key concepts include:

- Energy and motion is described by an object's direction and speed **(SOL 4.2a)**
- forces cause changes in motion **(SOL 4.2b)**
- friction is a force that opposes motion **(SOL 4.2c)**
- moving objects have kinetic energy **(SOL 4.2d)**

What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
Essential Questions: • What is energy? • What is the property of matter that causes change of motion? • Friction is the resistance of what force? • What is kinetic energy? **Critical Attributes:** 4.2a Energy is the ability to do work and work is the result of a force moving an object for a distance. While energy is present in many sources, it may not be working all the time. 4.2 a Speed is a measure of motion and describes the direction of an object's motion; up, down, forward, backward. 4.2b Inertia is the property of matter that causes it to resist any change of its motion in either direction or speed. Unless acted on by a force (a push or pull that causes an object to move, stop, or change speed or direction), objects in motion tend to stay in motion and objects at rest tend to remain at rest. 4.2c Friction is the resistance to motion created by two objects moving against each other. Friction creates heat. 4.2d Energy in motion is called kinetic energy. Energy that is not in motion, but could be due to its position, is potential energy. Examples of potential energy include a stretched rubber band before it is released and food before it is eaten. Potential energy changes to kinetic energy when a stretched rubber band is released or when the food is digested.	• Explain that energy is needed to do work. • Explain and demonstrate inertia. • Identify the forces that cause an object's motion. • Explain that speed is a measure of motion and describe the direction of an object's motion: up, down, forward, backward. • Design an investigation to determine the effect of friction on moving objects. • Infer that objects have potential and kinetic energy.

MAPPING GRADE 4 SCIENCE INSTRUCTION

Concept: Electricity
PWC Strand: Physical Science

CMS Unit Test: *The Nature of Electricity*
SOL Reporting Category: *Force, Motion, Energy, Matter*

PWC Objective: 4.4.2

The student will investigate and understand the characteristics of electricity. Key concepts include:

- conductors and insulators **(SOL 4.3a)**
- basic circuits (open/closed, parallel/series) **(SOL 4.3b)**
- static electricity **(SOL 4.3c)**
- ability of electrical energy to be transformed into heat, light, and mechanical energy **(SOL 4.3d)**
- simple electromagnets and magnetism **(SOL 4.3e)**
- historical contributions in understanding electricity **(SOL 4.3f)**

What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
Essential Questions: • What are some sources we use to produce electricity? • What is the difference between a conductor and an insulator? • What are closed and open circuits? How does electricity flow in a series and parallel circuit? • What is the relationship between magnetism and electricity? • Who are the major contributors to our understanding of electricity?	
Critical Attributes: 4.3a Materials that electricity flows through are known as conductors. Good conductors allow electricity to flow easily, but poor conductors do not allow electricity to flow well. Insulators are materials that don't let electricity flow at all. We often use the term "resistance" to describe how well electricity will flow in a material. Electrical wires in our homes contain a conductor, like a metal such as copper or aluminum, wrapped in the protective coating of an insulator, like rubber or plastic.	• Describe the roles of insulators and conductors in electrical circuits and give examples of each.

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What Students Should Know (Critical Attributes)	**What Students Should Be Able To Do** (Essential Skills)
4.3b A circuit must have an energy source (such as from a battery), a wire, and a device that will use the electricity (like an appliance or a light bulb). A closed circuit allows the electricity to flow from the battery, through the wire, to the appliance or light bulb, and back to the battery. An open circuit is "broken" and does not let the electricity complete its travel through the entire circuit. *A pathway taken by an electric current is a circuit.* In a series circuit there is only one pathway for the current, but in a parallel circuit there are two or more pathways for it. 4.3c A type of electricity that is produced naturally is static electricity. Static is produced by friction when certain objects rub together, building an electric charge between them. Lightning is the discharge of *static electricity* in the atmosphere. 4.3d Electricity has many uses in our homes. Electrical energy can be transformed into light, heat, sound, and mechanical energy that can be used to run appliances such as ovens, television sets, and stereos. 4.3e Electricity is related to magnetism. A current running through a wire and a magnet both produce a magnetic field. We can produce a magnet that can be "turned on and off" by wrapping a current carrying wire around a nail. When current moves through the wire, the moving magnetic field creates an electric current. We use electromagnets in many everyday devices, including computer disk drives, electric motors and doorbells. 4.3f Historical contributions to the study and understanding of electricity. Benjamin Franklin, Thomas Alva Edison, and Michael Faraday were instrumental in the sciences of electricity, recording sound and the light bulb and the understanding of electromagnetism.	• Apply the terms open and closed in describing electrical circuits. • Use the dry cell symbols (-) and (+). • Differentiate between an open and closed electrical circuit. • Differentiate between a parallel and a series circuit. • Create and diagram a functioning series circuit using dry cells, wires, switches, bulbs, and bulb holders. • Create and diagram a functioning parallel circuit using dry cells, wires, switches, bulbs, and bulb holders. • Explain how static electricity is created and occurs in nature. • Design an investigation using static electricity to attract and repel a variety of materials. • Explain how electricity is related to magnetism. • Create a diagram of a magnetic field using a magnet. • Explain how electricity is generated by a moving magnetic field. • Compare and contrast a permanent magnet and an electromagnet. • Construct a simple electromagnet using a wire, nail, or other iron-bearing object, and a dry cell. • Design and perform an investigation to determine the strength of an electromagnet (the manipulated variable could be the number of coils of wire and the responding variable could be the number of paperclips the magnet can attract). • Describe the contributions of Ben Franklin, Michael Faraday, and Thomas Edison to the understanding and harnessing of electricity.