Norfolk Public Schools
Science Learning in Place Plan: Science 7 Honors Lessons

Week 4: April 6 – 10, 2020

Monday	Tuesday	Wednesday	Thursday	Friday
Electricity & Magnetism Reading & Text Annotation: • Read "Electricity & Magnetism" **pages 1 – 2 Electric Currents & Circuits** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Electricity & Magnetism** Concept Analysis: • Review the passage "Electricity & Magnetism" **pages 1 – 2 Electric Currents & Circuits** • Answer the questions on the handout **"Electric Currents & Circuits Analysis Questions"**	**Electricity & Magnetism: Circuits** Concept Analysis: • Complete the worksheet entitled, **"Electricity & Magnetism: Circuits"**	**Electricity & Magnetism** Reading & Text Annotation: • Read "Electricity & Magnetism" **page 1 – Electricity and Magnetism** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Electricity & Magnetism** Concept Analysis: • Review the passage "Electricity & Magnetism " **page 1 – Electricity and Magnetism** • Answer the questions on the handout **"Electricity and Magnetism Analysis Questions"**

Week 5: April 13 – 17, 2020

Monday	Tuesday	Wednesday	Thursday	Friday
Spring Break				

Week 6: April 20 – 24, 2020

Monday	Tuesday	Wednesday	Thursday	Friday
Matter Reading & Text Annotation: • Read "Force, Motion, Energy & Matter" **The Particle Theory of Matter** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Matter** Concept Analysis: • Review the passage Read "Force, Motion, Energy & Matter" **The Particle Theory of Matter** • Answer the questions on the handout **"The Particle Theory of Matter Analysis Questions"**	**Matter** Reading & Text Annotation: • Read "Force, Motion, Energy & Matter" **The Phases of Matter** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Matter** Concept Analysis: • Review the passage Read "Force, Motion, Energy & Matter" **The Phases of Matter** • Answer the questions on the handout **"The Phases of Matter Analysis Questions"**	**Matter** Concept Analysis: • Complete the worksheet entitled, **"Particle Theory"**

CRITICAL READING *strategies*

Marking the Text

- # → Number the paragraphs
- → Circle key terms
- → Underline essential info
  (...based on the reading purpose)
- → Box new vocab words
  (...and define them in the margins)

Additional Ways to Mark the Text

- → [Bracket] information
  (when underlining has been used for another purpose)
- → Write labels in the margins
  (double underline labels to stand out from other marks)

Electricity & Magnetism Concept Analysis

Directions: Answer and justify each question. Justify your answer by indicating the paragraph that supports your answer.

Electric Currents & Circuits Analysis Questions	**Justifications**
1. What is the build up of electrical charges called?	1.
2. When is electricity generated?	2.
3. Why can resistance be thought of as electrical friction?	3.
4. List several applications for semiconductors.	4.

Electricity and Magnetism Analysis Questions	**Justifications**
1. What is the relationship between a magnetic field and an electric current?	1.
2. How are electromagnets produced?	2.
3. How does a generator convert mechanical energy into electrical energy?	3.
4. How does an electric motor turn electrical energy into mechanical energy?	4.

Electricity and Magnetism:

Electric Currents & Circuits

Have you ever experienced a shock after walking across a carpeted floor and then touching something? That shock was the result of an **electrical charge**. The friction between your shoes and the carpet caused electrons to be transferred from the atoms of the carpet to the atoms of your shoe. This caused your shoes to have a negative charge which can be discharged slowly over time or rapidly when you touch another object in the room. This build up of electrical charges is often called **static electricity**.

Static electricity is a form of electricity that is found naturally in nature. Electricity, however, can also be produced by humans. To understand how electricity works, we need to review what we know about matter. We know that all matter is made up of tiny particles called **atoms**. Every atom is made up of a central nucleus that has a positive charge and a cloud of circling electrons that has a negative charge. **Electricity is generated when electrons flow between atoms.**

A continuous flow of charge creates an **electrical current**. This current of electricity travels in a path called a **circuit**. A circuit can be closed and open. A **closed circuit** is like a road that crosses over a river by way of a drawbridge. When the bridge is down, your car can travel on the road, cross the water, and continue on the other side. In the same way, a closed circuit allows electrical energy (electrons) to continue flowing and moving. **A closed circuit has no breaks in it to stop the flow of electricity.**

An **open circuit** is also like a road that crosses over a river by way of a drawbridge. This time, however, the drawbridge is up and the car can go no farther. In an open circuit, a similar thing happens. The movement or flow of electrical energy (electrons) is stopped. **An open circuit has a break in it that stops the flow of electricity.**

Electricity and Magnetism:

Electric Currents & Circuits

In addition to being open and closed, an electrical circuit can also have a different number of pathways. A circuit that has only one pathway for the electrical current is called a **series circuit**. You can make your own series circuit by allowing an electrical charge to flow from a battery, through a wire, through one or more bulbs, and back to the battery. Series circuits are used in some holiday lights. They do have a major disadvantage. If one of the bulbs burns out in a series circuit, the entire string of lights goes out. **This is because when one part of a series circuit stops working, it creates an open circuit and no current can flow through it**.

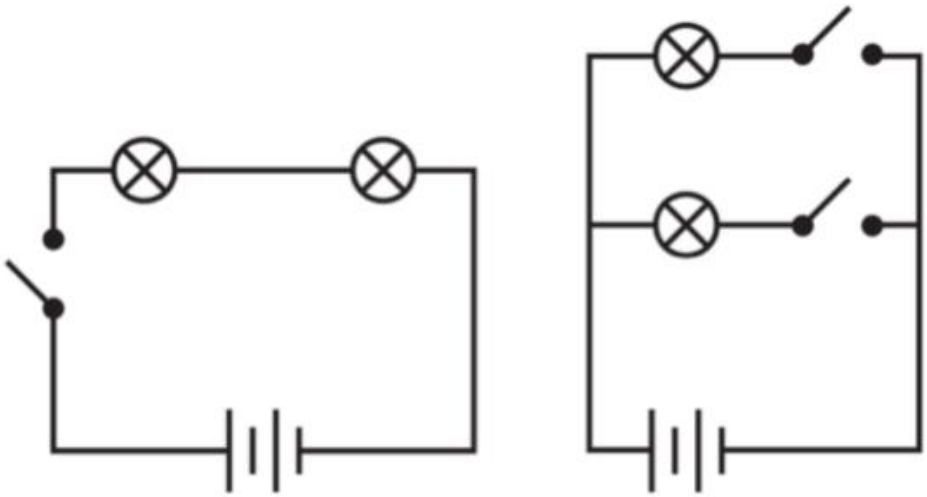
A circuit that has two or more pathways is called a **parallel circuit**. Parallel circuits have different pathways or branches. This allows the electrical current to travel through all or some of the pathways. In a parallel circuit an electrical charge flows from the battery, through a wire, and to each of the bulbs separately before returning to the battery. Most circuits in your house are parallel circuits. This allows you to turn some lights and appliances off while others are still being used.

As a current of electricity flows through the wires of a circuit, its movement is caused by an electric force. This force is called **voltage**. Voltage pushes electricity through a wire like water through a pipe. **The higher the voltage, the more forceful the electric current.**

Another factor that affects how much electricity can flow through a system is **resistance.** Resistance is the property of matter that affects the flow of electricity. It can be thought of as electrical friction because it opposes, or resists, the flow of electrical charges. Some substances have more resistance than others. Resistance is related to the material a substance is made of, its thickness, length, and temperature. **Conductors** of electricity, such as copper and other types of metal, have low resistance and are used in circuits to allow the flow of electricity. **Insulators** such as rubber and glass have a higher resistance and restrict or block the flow of an electric current.

Semiconductors, such as diodes and transistors, are materials with medium resistance – somewhere between a conductor and an insulator. **Diodes** are very simple semiconductors that allow limited one-way travel of electrons in applications such as solar cells and light emitting diodes (LED). LED lights are widely used in television sets and laptop computers. **Transistors** are semiconductors made mostly from silicon that amplify or strengthen the electrical signals in devices like stereos and radios.

Electricity & Magnetism: Circuits



Circuit A

Circuit B

a) What is the difference between the arrangements of the bulbs in circuits A and B?

_____

_____

b) Name the advantages and disadvantages of using Circuit B to connect bulbs.

_____

_____

_____

_____

Electricity and Magnetism

We have learned that electricity is a form of energy that is found in nature but that can be produced artificially by man. It involves the continuous flow of electrons from atom to atom. Another form of energy is also created by the movement of electrons. This form of energy is called **magnetism.**

Magnetism and electricity share a very unique relationship; magnetic fields can produce an electric current and an electric current can produce a magnetic field known as an electromagnet. Let's investigate this unique relationship between electricity and magnetism!

There are two basic kinds of magnets: **permanent** and **electromagnetic**. Permanent magnets occur in nature but can also be man-made. In a permanent magnet the magnetic properties (electrons flowing in the same direction and two opposite poles) are always present.

Electromagnets, however, are temporary. They are produced by taking a solid piece of metal, like a nail, and wrapping it with a wire that is carrying an electric current from a source such as a battery. The current flowing through the coiled wire creates a magnetic field. A magnetic field surrounds a magnet and exerts a force on other magnets and magnetic objects nearby. The strength of an electromagnet can be increased or decreased by changing the number of coils or the strength of the electrical current flowing through the coiled wire. Electromagnets lose their magnetism when the electric current is removed.

Most of the electricity we use every day is produced by generators. A **generator** is a machine that converts mechanical energy into electrical energy. Generators do this by a process called electromagnetic induction. Electromagnetic induction occurs when a coil of wire is rotated between the poles of a permanent magnet.

The electrical energy produced by power plant generators is sent by electric current to our homes, schools, and businesses. Electric motors found in household appliances such as blenders and washing machines convert this electrical energy into mechanical energy that is used to do work. Like power plant generators, the electric motors in our homes also use electromagnets. In a simple electric motor, an electromagnet spins between the poles of a permanent magnet. In this way electrical energy is turned into mechanical energy.

Matter Concept Analysis

<u>Directions</u>: Answer and justify each question. Justify your answer by indicating the paragraph that supports your answer.

The Particle Theory of Matter Analysis Questions	**Justifications**
1. What do most things around us have in common?	1.
2. What is a theory?	2.
3. What do scientists use to help explain the properties and characteristics of matter on Earth?	3.
4. Describe the movement of the particles.	4.

The Phases of Matter Analysis Questions	**Justifications**
1. What are the four phases of matter? How are they different?	1.
2. Describe the effect of movement of particles in a solid on their attraction.	2.
3. Describe the effect of movement on particles in a liquid on their attraction.	3.
4. What is one unique way gases are different from solids and liquids?	4.

The Particle Theory of Matter

Look around your classroom. In most classrooms we will find desks, tables, books, paper, pencils, book bags, students, and teachers. Although they all look very different, all of these things have something in common. They are all made of **matter**! What is matter? What is matter made of? How can we classify and describe it? What are its properties? Let's answer these questions by investigating the basic nature of matter!

Since ancient times, men have been studying and questioning the world of matter around them. Over two thousand years ago, a Greek philosopher by the name of Democritus put forth a theory about matter. A **theory** is a statement developed to explain observations of our natural world. His theory proposed that all substances were composed, or made, of very small **particles** that are too small to be seen by the human eye. He called these particles *atomos*.

Since Democritus' time, scientists have continued to study matter. Today we define matter as anything that has **mass** and **volume**. Mass is the amount of matter in a substance. Volume is the amount of space the substance occupies. The tiny particles that create the mass of a substance and cause it to take up space are now called **atoms**. Scientists use the kinetic or **particle theory of matter** to help explain the properties and characteristics of different substances on Earth. This **theory** can be summarized in the following statements:

1. All matter is made up of extremely small particles.
2. All particles of one substance are the same. Different substances contain different particles.
3. These particles are always moving. They rotate, vibrate, or travel in straight lines. When energy, like heat, is added to these particles, they move faster.
4. There are spaces between the particles. When energy is added, particles tend to move farther apart.
5. The particles in a substance attract one another. The slower particles move, the stronger their attraction to each other. The stronger the attraction, the closer together the particles become.

The Phases of Matter

Matter can be a **solid**, **liquid**, **gas**, or **plasma**. Each of these phases has different properties. Let's use our knowledge of the particle theory of matter to describe and understand the properties of the **phases of matter**.

As we have learned, all matter is composed of tiny particles or **atoms** that are attracted to each other and are in constant motion. In a **solid,** these particles move so slowly they cannot overcome their strong attraction. This attraction causes them to be packed tightly together. They are so close together, they can only vibrate in place. As a result, **solids have a definite shape and volume**.

The particles in a **liquid** move quickly enough to overcome some of their attraction to each other. Unlike the vibrating particles of a solid, the particles of a liquid are able to slide past each other. As a result, **liquids do not have a definite shape and will flow and take the shape of the container** in which they are placed.

A **gas** consists of particles that are widely spread out and are moving around very rapidly. Gas is the only phase of matter that is highly compressible. Although a **gas does not have a definite shape and will flow and expand** (like the air we breathe), **gas particles can be compressed** (like a helium tank) **and will take the shape of its container** (like a balloon).

Another phase of matter is **plasma**. Plasma makes up 99% of the universe including the stars. Plasma is not common on Earth although it does appear in fluorescent and neon lights. **Plasma does not have definite shape or volume.** It is similar to gases and liquids in that it flows; however, plasma has some unique qualities. Its' ability to break electrons away from atoms is one way plasma is different from liquids, solids, and gases.

Changes from one phase to another are caused by adding or taking away energy, such as heat for example. When thermal (heat) energy is added to a substance, the particles in that substance begin to move faster, lose their attraction to each other, and space themselves farther and farther apart. When the energy is removed, the particles slow down, become more attracted to each other, and move closer and closer together.

Particle Theory

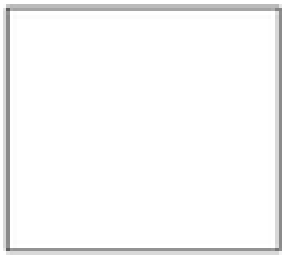
1. Solids are hard and cannot be squashed (compressed). They are heavy. They cannot flow so stay as one shape.

I think that the particles in a solid are arranged like this:

The particles in a solid are actually arranged like this:

2. Liquids can flow. Their shape can change. Liquids cannot be compressed.

I think that the particles in a liquid are arranged like this:



The particles in a liquid are actually arranged like this:

3. Gases take up a lot of space. They are light and can move about. They can be compressed

I think that the particles in a gas are arranged like this:

The particles in a gas are actually arranged like this: