Norfolk Public Schools
Science Learning in Place Plan: Science 8 Lessons

Week 4: April 6 – 10, 2020

Monday	Tuesday	Wednesday	Thursday	Friday
Changes in Matter and Energy Reading & Text Annotation: • Read "Changes in Matter and Energy" **page 1 – Physical and Chemical Changes** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Changes in Matter and Energy** Concept Analysis: • Review the passage "Changes in Matter and Energy" **page 1 – Physical and Chemical Changes** • Answer the questions on the handout **"Physical and Chemical Changes Analysis Questions"**	**Changes in Matter and Energy** Reading & Text Annotation: • Read "Changes in Matter and Energy" **page 2 – Chemical Reactions** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Changes in Matter and Energy** Concept Analysis: • Review the passage "Changes in Matter and Energy" **page 2 – Chemical Reactions** • Answer the questions on the handout **"Chemical Reactions Analysis Questions"**	**Changes in Matter and Energy** Reading & Text Annotation: • Read "Changes in Matter and Energy" **page 3 – The Law of Conservation of Energy.** • Use *Critical Reading Strategies* to make note of the key points in the passage.

Week 5: April 13 – 17, 2020

Monday	Tuesday	Wednesday	Thursday	Friday

S p r i n g B r e a k

Week 6: April 20 – 24, 2020

Monday	Tuesday	Wednesday	Thursday	Friday
Changes in Matter and Energy Concept Analysis: • Review the passage "Changes in Matter and Energy" **page 3 – The Law of Conservation of Energy"** • Answer the questions on the handout **"The Law of Conservation of Energy Analysis Questions"**	**Motion, Force, and Work:** **Speed, Velocity, Acceleration** Reading & Text Annotation: • Read "Speed, Velocity, Acceleration" **page 1 – Motion** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Motion, Force, and Work:** **Speed, Velocity, Acceleration** Concept Analysis: • Review the passage "Speed, Velocity, Acceleration" **page 1 – Motion** • Answer the questions on the handout **"Motion Analysis Questions"**	**Motion, Force, and Work:** **Speed, Velocity, Acceleration** Reading & Text Annotation: • Read "Speed, Velocity, Acceleration" **page 2 – Velocity** • Use *Critical Reading Strategies* to make note of the key points in the passage.	**Motion, Force, and Work:** **Speed, Velocity, Acceleration** Concept Analysis: • Review the passage "Speed, Velocity, Acceleration" **page 2 – Velocity** • Answer the questions on the handout **"Velocity Analysis Questions"**

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)

Changes in Matter and Energy Concept Analysis

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

Physical and Chemical Changes Analysis Questions	Justifications
1. What happens to a substance when it undergoes a physical change?	1.
2. What does a physical change cause?	2.
3. What happens to a substance when it undergoes a chemical change?	3.
4. Why does this change occur?	4.
Chemical Reactions Analysis Questions	**Justifications**
1. How do we classify chemical reactions?	1.
2. What is the difference between exothermic and endothermic reactions?	2.
3. What do scientists use to represent the changes that take place in a chemical reaction?	3.
4. What does the arrow indicate?	4.
The Law of Conservation of Energy Analysis Questions	**Justifications**
1. What does the Law of Conservation of Matter state?	1.
2. Are physical and chemical changes the only changes matter can undergo?	2.
3. What happens during nuclear reactions?	3.
4. What are the potential negative effects of using nuclear energy?	4.

Changes in Matter and Energy

We have learned that all matter on Earth can be identified and described by certain physical and chemical properties or characteristics. Matter can also be identified by the changes it can undergo. Let's investigate some different types of changes and how matter is affected.

A **physical change** affects the physical properties of a substance. When a substance undergoes a physical change, its particles are simply rearranged. This causes its identity and chemical composition to remain the same. For example, bending a nail or tearing a piece of paper are examples of **physical changes**. In both cases the original substance looks different, but its chemical composition and identity remain the same. The smaller pieces of paper are still paper and the bent nail is still a nail. Another example of a physical change takes place when matter changes phase or state. When water freezes into an ice cube or evaporates into water vapor through boiling, it is still water. Its chemical composition and identity have not changed. Changes in size, shape, or phase of matter are called **physical changes**.

A **chemical change** is a change that results in the formation of new substances. When a substance undergoes a chemical change its identity and chemical composition change. This change happens because the bonds between its particles are broken and they reform in a different arrangement. For example, if you burn the pieces of paper, a **chemical change** takes place. Oxygen and heat combine to ignite the paper. As the paper is burned, its particle bonds begin to break and reform new bonds producing carbon dioxide and water. Another kind of chemical change happens if the nail is left outside. Eventually, the iron in the nail will react with water and oxygen to produce rust. The top layer of the nail has turned into an entirely different substance. Changes that result in the formation of new substances are called **chemical changes**.

Changes in Matter and Energy

Chemical reactions can be classified into two main groups: **exothermic** and **endothermic**. **Exothermic chemical reactions** release energy. The burning of wood is an example of an exothermic reaction. **Endothermic chemical reactions** absorb energy. This type of reaction requires a continuous input of energy. Baking bread is an example of an endothermic reaction.

Scientists use a **chemical equation** to represent the changes that take place in a chemical reaction. A chemical equation is a combination of chemical symbols and formulas that explain what happens during a chemical reaction.

$$\mathbf{CH_4 + 2\ O_2} \rightarrow CO_2 + 2\ H_2O$$

On the left side of the equation are the chemical formulas for the **reactants**. Reactants are the starting materials in a chemical reaction. A plus sign is used to separate the formulas of the reactants.

$$CH_4 + 2\ O_2 \rightarrow \mathbf{CO_2 + 2\ H_2O}$$

On the right side of the equation are the chemical formulas of the **products**. The products are the substances formed during the chemical reaction. A plus sign is used to separate the formulas of the products. An arrow is used to separate the left side of the equation from the right. The arrow indicates that chemical change has taken place.

We have learned that during a **chemical reaction** the particles or atoms of a substance (**reactant**) break their bonds to other atoms and rearrange themselves to form a new substance (**product**). Interestingly, no atoms are lost during this change, or reaction. The number of atoms present in the reactants always equals the number of atoms in the products. This fact is supported by the **Law of Conservation of Matter (Mass).** This law states that matter is not created or destroyed during physical and chemical reactions. Regardless of how substances are changed during a reaction, the total mass remains the same.

Changes in Matter and Energy

A similar phenomenon occurs with energy. The **Law of Conservation of Energy** states that energy cannot be created or destroyed but only changed from one form to another. This law is demonstrated every time we turn on a light. As electrical energy enters the light bulb, it is converted, or changed, into light and heat energy. The total amount of light and thermal (heat) energy equals the amount of electrical energy that entered the bulb.

In addition to physical and chemical changes, matter can also undergo **nuclear reactions**. Nuclear energy is the energy stored in the nucleus of an atom. This energy can be released by the processes of **nuclear fusion** and **nuclear fission**. In **nuclear fusion** two or more nuclei join together, or fuse. The result is a massive nucleus and the release of large amounts of energy. The Sun produces energy through nuclear fusion. In **nuclear fission** energy is released when a large nucleus splits into two smaller nuclei. Nuclear power plants use nuclear fission to produce electrical energy. In both of these nuclear reactions, small amounts of matter are converted into tremendous amounts of energy.

Nuclear energy plants can produce large amounts of energy from small amounts of fuel. The use of nuclear energy saves Earth's fossil fuels and reduces the amounts of gases, such as carbon dioxide (pollution), that are released into the atmosphere. There are also possible negative effects of using nuclear energy. Some of these include the storage and disposal of radioactive nuclear waste and the possibility of nuclear accidents. One such accident occurred in Chernobyl, Ukraine in 1986. An explosion at the nuclear plant released a cloud of radioactive fuel and waste that spread over the continents of Europe and Asia.

Motion, Force, and Work: Speed, Velocity, Acceleration Concept Analysis

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

Motion Analysis Questions	**Justifications**
1. When does motion take place?	1.
2. What is speed in simple terms?	2.
3. What is speed in scientific terms?	3.
4. What formula do scientists use to calculate the speed of an object?	4.
Velocity Analysis Questions	**Justifications**
1. What is another concept that is closely related to motion and speed?	1.
2. What is velocity in simple terms?	2.
3. How do scientists measure velocity?	3.
4. When will an object's velocity change?	4.

Motion, Force, and Work:

Speed, Velocity, Acceleration

If your school is like mine, it is filled with motion. Everywhere you look kids are walking to class, running around the gym, pushing through crowded hallways, and pulling open locker doors. Outside buses screech to a stop to pick up kids, while others accelerate in a puff of black exhaust smoke as they leave to deliver their noisy load. If you think about it, this world would be a pretty boring place without motion. Let's investigate how the scientific principles of **motion**, **force**, and **work** impact the busy world around us!

To begin our investigation, let's discuss some important concepts that will help us understand motion, force, and work. The first concept we need to look at is **motion**. Motion takes place when an object changes its position in relation to a specific reference point. A good example of this would be the hallway outside your science class. As you step into the hallway on your way to lunch, you see your best friend at his locker. After opening your locker you look up again and see that he is turning the corner at the end of the hallway. Although you did not see him move, you can infer that he did because his position in relation to his locker, or reference point changed.

Closely related to the concept of motion is **speed**. In simple terms, speed is how fast an object is moving. In scientific terms, speed is the change in position of an object per unit of time. Scientists use the following formula to calculate the speed of an object.

Speed = distance/time (s = d/t)

To calculate the speed at which your friend traveled, you would measure the distance he traveled between his locker and the end of the hallway (15 meters) and divide that number by the number of seconds it took him to cover that distance (10 seconds). Your friend's speed would be calculated as 1.5 meters per second.

15 meters/10 seconds = 1.5m/s

Motion, Force, and Work:
Speed, Velocity, Acceleration

Velocity is another concept closely related to motion and speed. Velocity in simple terms is speed with a direction. To measure velocity, scientists look at the speed of an object and the direction in which it is moving.

For instance, to calculate your friend's **velocity**, you would have to combine his speed and the direction in which he is traveling. If he is traveling north down the hall towards the lunchroom, his velocity would be 1.5 m/s north. As your friend approaches the hall that leads to the lunchroom, you notice that his speed stays the same but his direction changes. Turning the corner, he is still traveling at a speed of 1.5m/s, but his velocity has changed to 1.5 m/s east. As your friend enters the lunchroom he slows down but continues to travel in the same direction. This time your friend's velocity changes because his speed changed. His velocity would now be calculated as 1 m/s east. **Simply stated, an object's velocity will change if there is a change in *speed*, *in direction*, or *both*.**

The concept of **acceleration** is also closely related to motion, speed, and velocity. As your friend traveled down the hallway towards the lunchroom, his speed and direction stayed the same. Because his velocity remained the same or constant, he had no acceleration. **An object moving with constant (not changing) velocity has no acceleration.**

For example, as your friend turned the corner, he accelerated because his velocity changed in respect to direction. As he slowed down to enter the lunchroom, he accelerated again because his velocity changed in respect to speed. Therefore, **acceleration is the change in velocity per unit of time, or simply stated, how quickly velocity changes**. When an object accelerates due to a decrease in speed, this is called negative acceleration or **deceleration**.