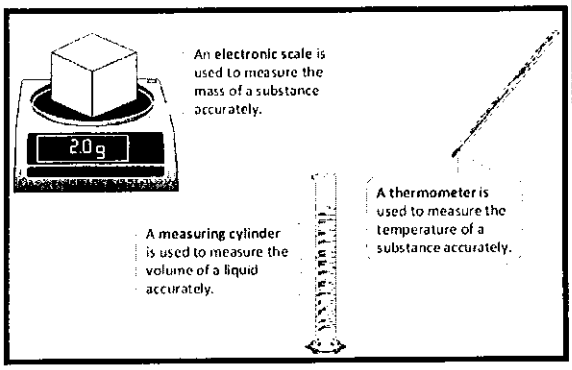
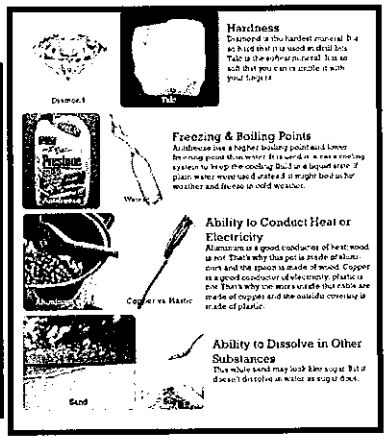
8.P.1.3.

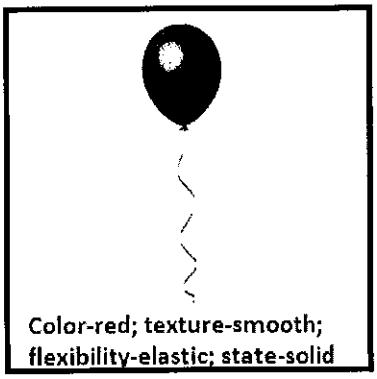
Observing Chemical Change

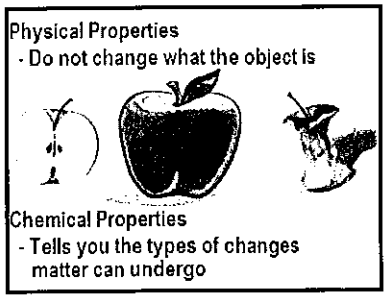
The study of matter and how it changes is called **chemistry.** We can **describe matter** by its ***physical properties*** and also by its ***chemical properties***. We can **describe changes in matter** in terms of ***physical or chemical changes.***

A **physical property** is a characteristic or trait of a substance that can be observed without changing the substance into another substance. It can still be identified as the original substance. Physical properties can be observed using the 5 senses and tools from a chemistry lab. For example, you measure the temperature at which a solid melts is a physical property. You see the color of a substance and touch the texture. States of matter (solid, liquid, or gas), malleability, density, and odor are other physical properties. Measurements, such as density, melting point, length, width, etc. are physical properties of a substance.

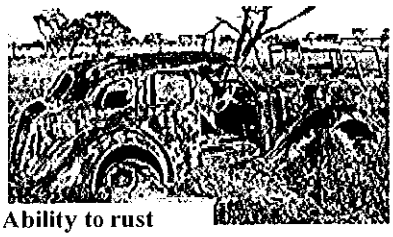


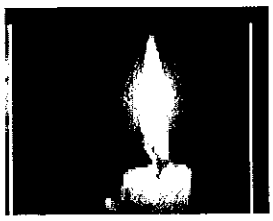




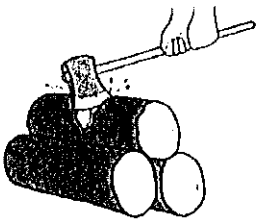


A **chemical property** is a way to describe how matter **reacts** with **other** matter, or **reactivity**. It is the characteristic of a substance that describes its ability to **change** into other substances. To observe the chemical properties of a substance, you must change it into ***another substance***. For example, to observe the reactivity of magnesium, you can let magnesium combine with oxygen to form a new substance called magnesium oxide. Or to see the chemical property of paper, observe if it reacts with oxygen in the air when you try to burn it, which is the chemical property called **flammability**. Or when metals react with oxygen (oxidation) and new substances are formed like rust oxide. Other reactions could be with water, light, and acid. **Toxicity** is also a chemical property since you can't tell by looking at a chemical whether or not it is toxic. How poisonous a substance is depends on the situation, so this is a property that can only be observed and measured by exposing an organic system to a sample. The exposure causes a chemical reaction or set of reactions. The net result of the chemical changes is the toxicity.


Ability to rust


Flammability

Physical Change



Chemical Change

Ashes

A **physical change** is any change that **alters** the form or appearance of a substance but does ***not make the substance into another substance.*** Examples of physical changes are bending and cutting or change of state as when an ice cube melts. It changes from the solid state to a liquid state, but it is still water (H_2O).

A chemical change in matter is one that produces one or more **NEW** substances. It is also called a **chemical reaction.** The burning of gasoline in a car's engine is a chemical change. Chemical changes occur ***when bonds form between atoms, or when bonds break. Then the atoms rearrange themselves and new bonds form.*** As a result, **new substances** are produced. A chemical reaction is the process of one or more substances converting to form new substance with different properties. One way to detect **chemical reactions** is to observe changes in the properties of the materials involved. Rusting iron, baking a cake, explosion of fireworks, rotting bananas, milk going sour, burning paper are examples of chemical changes. In each one of these a new substance is formed. Can you name them? Can you see the evidences?

Changes in properties result when new substances form. There are 4 clues that a chemical change may have taken place.

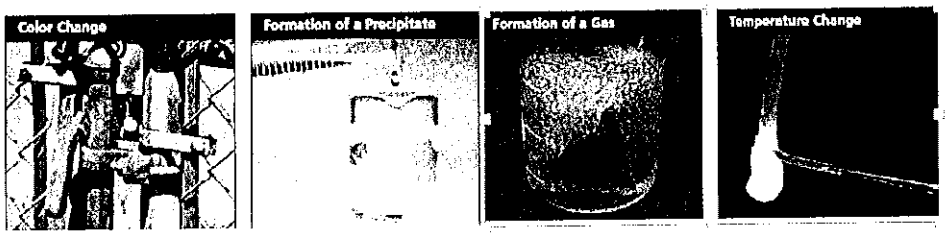
(1) a change in color or odor may signal that a new substance has formed.

(2) the formation of a solid called a **precipitate** when two liquids are mixed.

(3) the formation of a gas when solids or liquids react (bubbles or smoke)

(4) a change in temperature

These and other kinds of observable changes in properties may indicate that a chemical reaction has occurred.



New substances formed from chemical reactions will have different properties than the substances from which they were formed. For example, hydrogen gas is highly flammable and so is oxygen gas. Yet when they combine with a ratio of 2:1 (H_2O they make water which puts out fire. When paper with reacts with oxygen and burns, new substances of carbon dioxide and ash are created. Can't make a paper airplane with ash and smoke. Sodium which is a very reactive shiny solid metal combines with chlorine, a poisonous, green gas, and forms white crystals called NaCl – table salt that you put on your food and eat.

Remember to truly be a chemical change you MUST have at least one new substance that was not there before.

Name_____ **Observing Chemical Changes**

1. The study of matter and how it changes is called _____

2. We can describe matter by its _____ and _____ properties.

3. Changes in matter can be classified as either _____ or _____ changes

4. What is a physical property? _____

_____

5. What do you use when observing physical properties? _____

and _____

6. Name four physical properties of matter._____

7. A chemical property is the way to describe how matter reacts with

_____

8. To observe chemical properties of a substance, what must it form? _____

9. List 3 examples of chemical properties. _____

_____

10. Why is toxicity considered a chemical property? _____

_____

11. True or False? A physical change never alters the form or appearance of a substance.

12. True or False A physical change does not make the substance that is changing into a new substance.

13. Circle the letter of each choice that is a physical change in matter.

a. bending a straw b. boiling water c. burning wood d. braiding hair

14. A change in matter that produces one or more new substances is a(n) _____ change.

15. Another name for a chemical change is a chemical _____.

16. What happens to the bonds between atoms when chemical changes occur? (**Do Not Leave Blank.**)

_____

_____

17. Name the 4 indicators to help determine if a chemical change has taken place.

1. _____
2. _____
3. _____

18. A solid that forms during a chemical reaction is called a(n) _____.

19. Suppose you mix two clear liquids together to form a new substance and bubbles form.

What type of change has taken place? How do you know? Explain your answer.

_____

_____

20. List 4 examples of chemical changes. _____

_____

21. Compare the properties of new substances formed from the chemical reactions to the substance from which they were formed? _____

22. What is the **one** way that you know that a chemical change has happened? _____

_____

Did you get it?

Write P for physical or C for chemical to name the kind of change it is.

_____ Roasting marshmallows.

_____Melting butter.

_____Cutting grass.

_____Tarnish on silver,

_____Cooking an egg.

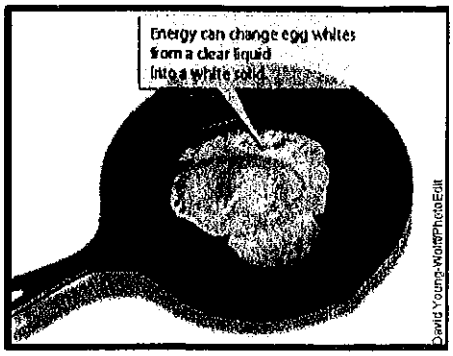
_____Freezing water for ice cubes

Exothermic Reaction
Reactants ⟶ Products + Energy

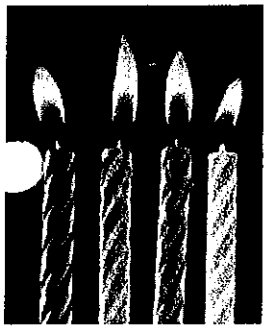
Endothermic Reaction
Reactants + Energy ⟶ Products

Chemical Reactions and Energy- Endothermic and Exothermic Reactions

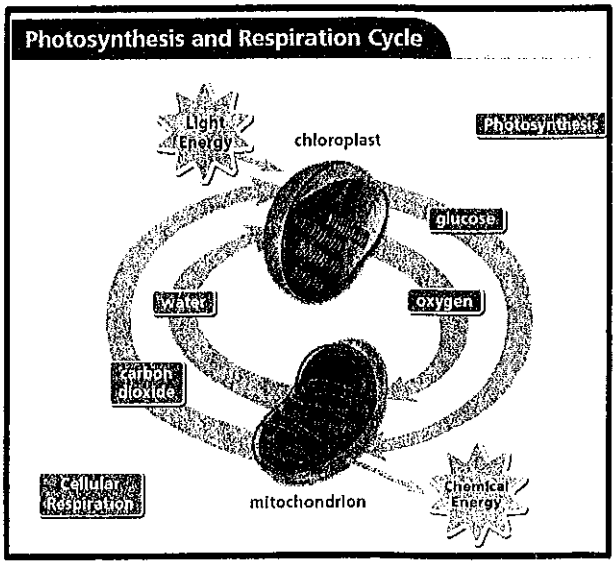
In a chemical reaction, the bonds between the atoms break, releasing the atoms present to rearrange themselves to produce new chemical compounds. Energy is needed for this since energy is the ability to change. During the breaking and forming of bonds, energy is either absorbed or released. One indication that energy has been absorbed or released is a change in temperature. Other indicators are light and sound.



Reactions that absorb energy are **endothermic** reactions. This means that a lot of energy is required to break the bonds of the substance(s) that are interacting to make a new substance(s). They are called the **reactants.** An example of this is when you fry an egg. It absorbs the energy of the matter around it and that causes it to change chemically. A fried egg is a chemical change in the egg. Often times as energy is absorbed in endothermic reactions, it may produce a decrease in temperature since the energy must be taken from the surroundings as heat in order to break bonds.



Reactions that release energy in the form of heat, light, and/or sound are **exothermic** reactions. In an exothermic reaction less energy is used to break the bonds of the reactants. Instead more energy is released in the **products**. Products are the new substances resulting from the chemical reaction. Fireworks exploding is an example. The energy is EXITING in the form of light and sound. A candle burning is exothermic. The energy is exiting in the form of light and heat. Another exothermic reaction occurs when fireflies light up due to a reaction that takes place between oxygen and a chemical called luciferin.



But the two most important endothermic and exothermic reactions on planet Earth are photosynthesis and cellular respiration. Without them, there could be no life on planet Earth.

In **photosynthesis**, energy from the sun is **absorbed** by plants, algae, trees, etc.as they convert carbon dioxide and water into a sugar called ***glucose*** and is then stored in them. Later, the energy is **released** in the organism that eats them in a process called **cellular respiration**. So, when you need to work or run and are looking for energy, you're really looking for your cells to release the energy stored in the food you ate. Look carefully at the chemical reactions below. See how the reactants of one become the **products** of the other and vice versa. It's what makes the world go round.

Photosynthesis
$6CO_2 + 6H_2O + \text{energy} \longrightarrow C_6H_{12}O_6 + 6O_2$

Respiration
$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}$

Name_____ **Endothermic and Exothermic Reactions**

1. Chemical reactions occur when bonds in molecules _____, and then _____ to form new substances.
2. What is necessary for the breaking and forming of bonds? _____
   Why? _____
3. True or False? Energy is only absorbed in a chemical reaction.
4. What is an indication that energy has been either absorbed or released?

   _____
5. What is an endothermic reaction? _____
6. What are the substances at the start of a reaction called? _____
7. If a lot of energy is needed to break the bonds of the reactants then the reaction is _____.
8. True or False? Endothermic reactions may result in a decrease in temperature.
9. What happens in an exothermic reaction? _____
10. In what forms is energy released during exothermic reactions? _____
11. Give an example of an exothermic reaction and explain why it is exothermic.

    _____

12. Why is photosynthesis considered an endothermic reaction? _____

    _____
13. What are the reactants in photosynthesis? _____
    What are the products? _____
14. From where is the energy being absorbed? _____
15. What are the products of photosynthesis? _____
16. Where is the energy? _____
17. In what process is energy released so it can be used by organisms? _____
18. What are the reactants in cellular respiration? _____
    What are the products? _____
19. Why you think these two reactions are the most important in the world?

    _____

    _____

Write endo or exo near each example.

Frying an egg _____
Cellular respiration _____
Burning a log _____
Photosynthesis _____
Breaking a cold pack _____
Lighting a candle _____