Chapter 2: Properties of Matter

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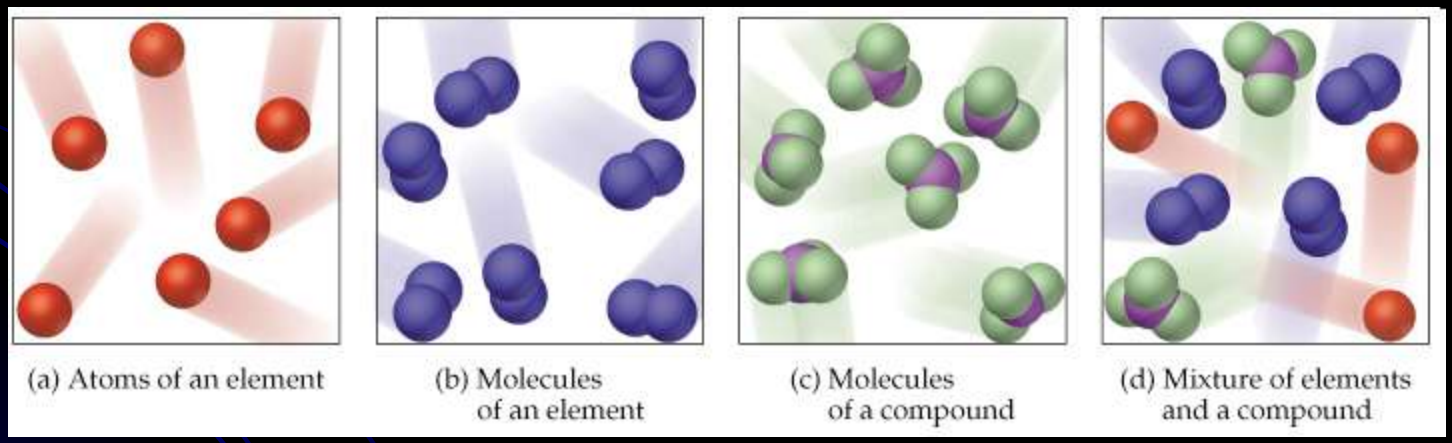
Warm-Up Jan. 29

1. What is matter?
2. What is a chemical change?
3. What are the 3 parts of an atom?

Section 2.1 – Classifying Matter

- Materials can be divided into pure substances and mixtures based on their compositions.

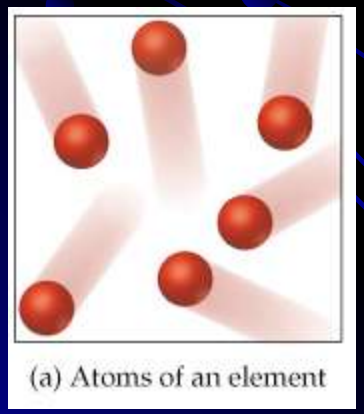


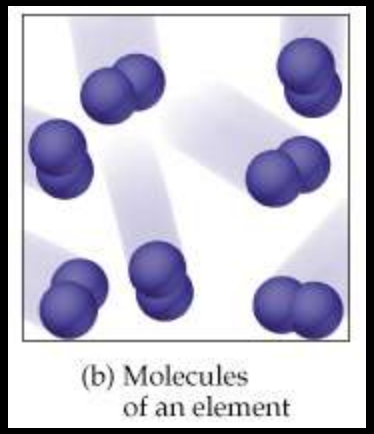
Pure Substances

- Matter that has exactly the same composition is classified as a pure substance.
- Every sample of a pure substance has the same properties because a substance has a uniform composition.
- Substances can be classified as elements or compounds.

Elements

- An element is a substance that cannot be broken down into simpler substances.
- An atom is the smallest particle of an element.
- An element has a fixed composition because it contains only one type of atom.


(a) Atoms of an element


(b) Molecules of an element

Elements

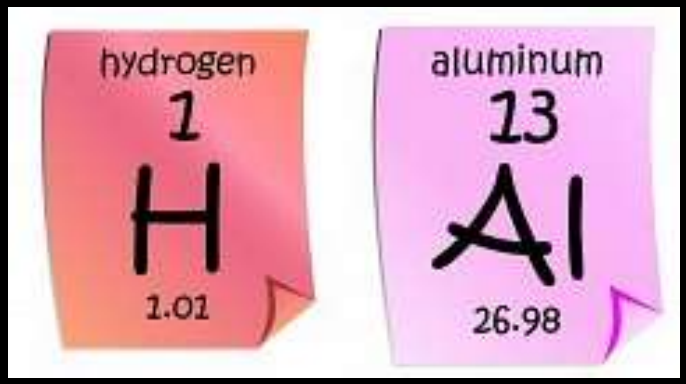
- Most elements are solids at room temperature.
- Some elements are gases at room temperature. Most of them are located on the upper right-hand side or the periodic table.
- Mercury and bromine are liquids at room temperature.

Symbols for Elements

- Each element symbol is either one or two letters.
- The first letter is always capitalized. If there is a second letter, it is lowercase.
- Some element symbols are based on the Latin names for elements.

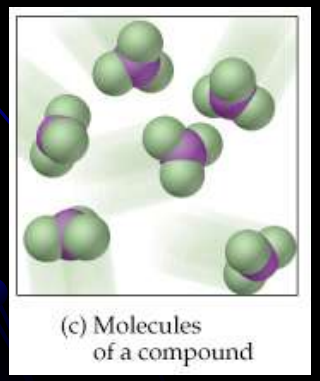
Ex: aurum = gold (Au)

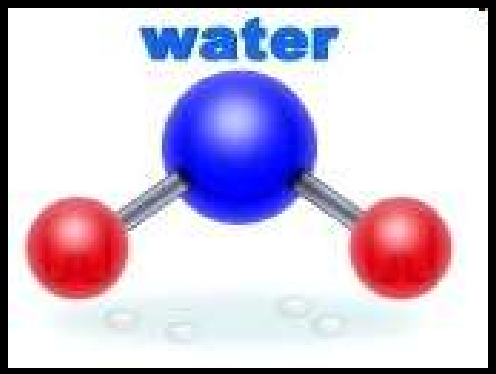
ferrum = iron (Fe)



Compounds

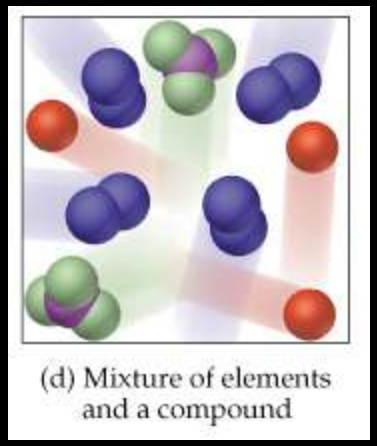
- A compound is a substance that is made of two or more simpler substances.
- The properties of compounds differ from those of the substances from which it is made.
- A compound always contains two or more elements joined in a fixed proportion.





Mixtures

- The properties of a mixture can vary because the composition of a mixture is not fixed.
- Mixtures tend to retain some of the properties of their individual substances.



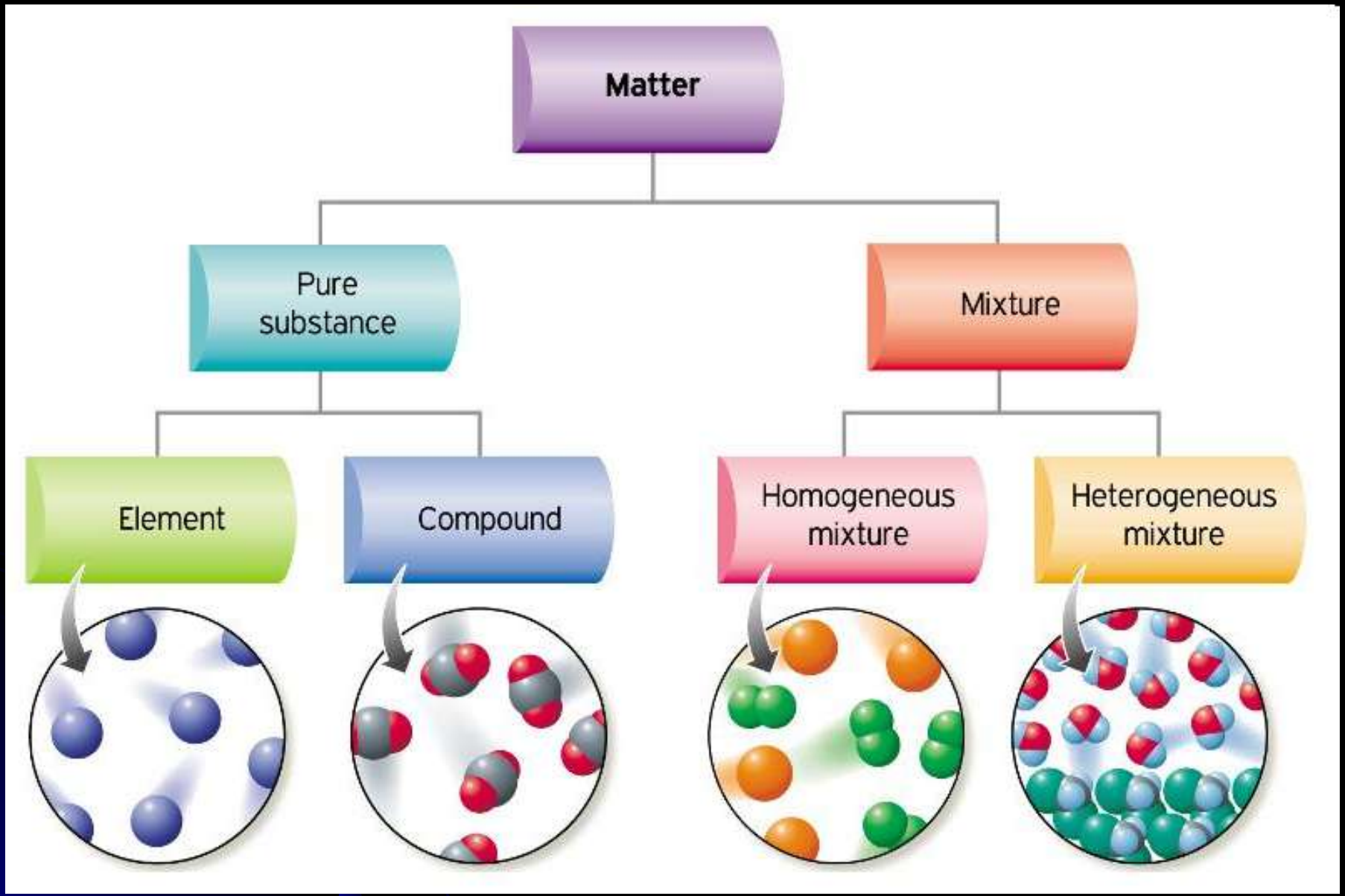
(d) Mixture of elements and a compound

Heterogeneous Mixtures

- In a heterogeneous mixture, the parts of the mixture are noticeably different from one another.

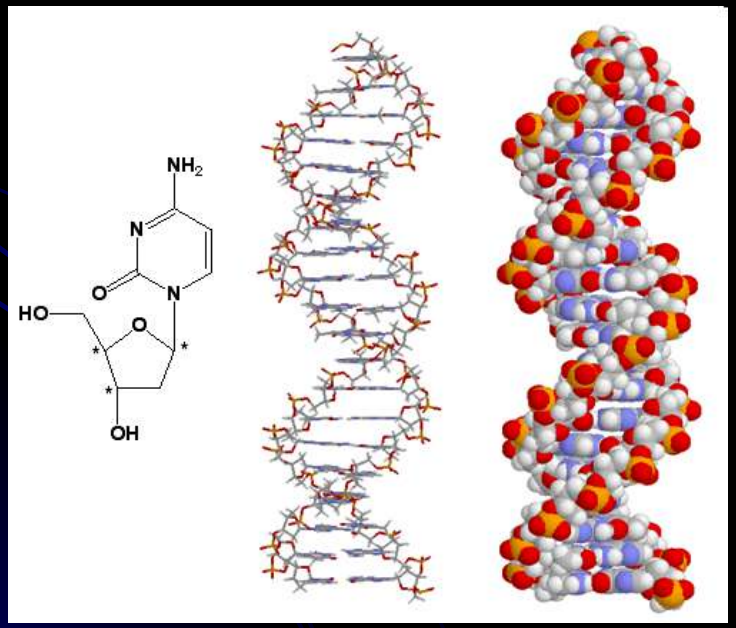
Homogeneous Mixtures

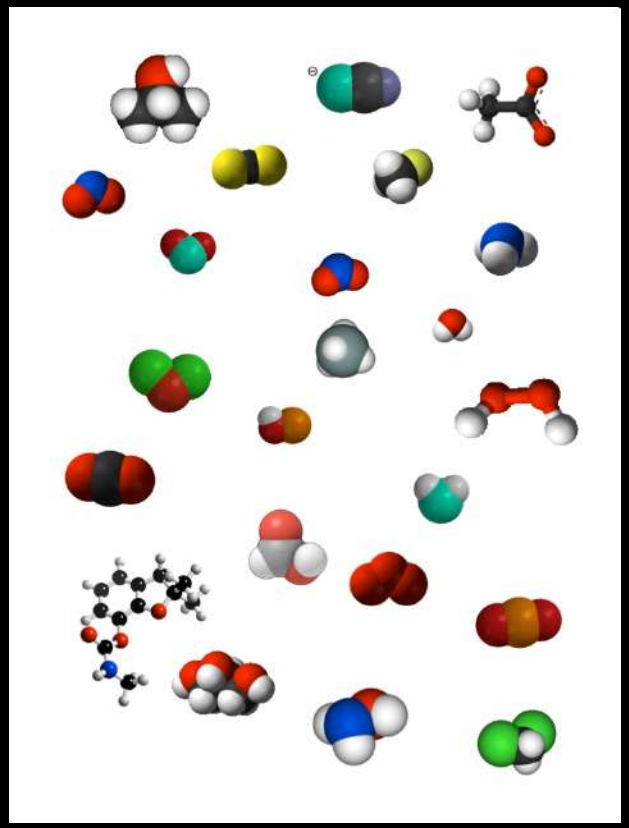
- In a homogeneous mixture, the substances are so evenly distributed that it is difficult to distinguish one substance from another, so it **appears** to be uniform.


Matter
Pure substance
Mixture
Element
Compound
Homogeneous mixture
Heterogeneous mixture

Mixtures

- Based on the size of its largest particles, a mixture can be classified as a solution, a suspension, or a colloid.





Solutions

- When substances dissolve and form a homogeneous mixture, the mixture that forms is called a solution.
- Properties of solutions: do not settle, cannot be filtered, allow light to pass through, and have small particles.
- Ex: windex, grape juice, and gasoline

Suspensions

- A suspension is a heterogeneous mixture that separates into layers over time.
- Properties of suspensions: settle over time, can be filtered, scatter light, and have large particles.
- Ex: Italian salad dressing, muddy water, and paint.

Colloids

- A colloid contains some particles that are intermediate in size.
- Properties of colloids: do not settle, cannot be filtered, scatter light, and have medium-sized particles.
- Ex: milk, ink, and Jell-O

Section 2.1 Assessment

- Why does every sample of a given substance have the same properties?
- Explain why the composition of an element is fixed.
- Describe the composition of a compound.
- Why can the properties of a mixture vary?
- On what basis can mixtures be classified as solutions, suspensions, or colloids?

Section 2.1 Assessment

- Explain why silicon dioxide cannot be the only compound in a sample of sand.
- Fresh milk is a suspension. After fresh milk is homogenized, it is a colloid. What happens to the size of the drops of fat in milk when it is homogenized?

Warm-Up Feb. 4

1. What are the 2 categories of matter?
2. What is an example of an element?
3. Is apple juice an example of a homogeneous or a heterogeneous mixture?

Section 2.2 – Physical Properties

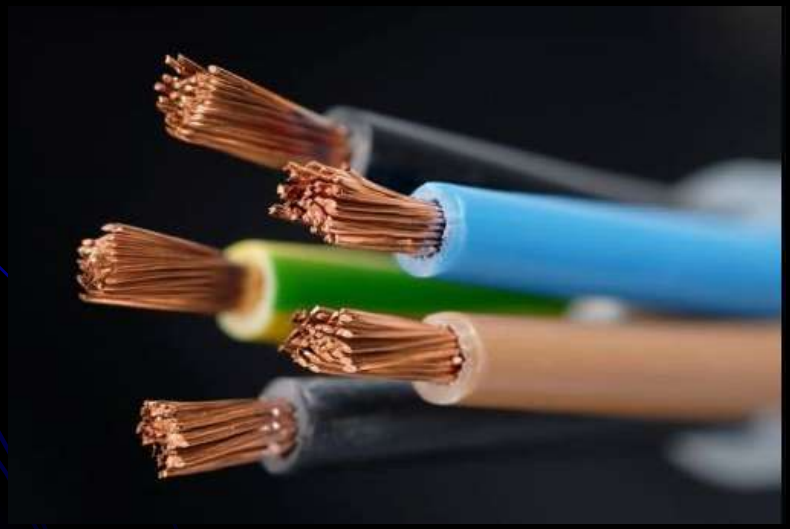
- A physical property is any characteristic of a material that can be observed or measured without changing the composition of the substances in the material.
- Viscosity, conductivity, malleability, hardness, melting point, boiling point, and density are examples of physical properties.

Viscosity

- The tendency of a liquid to keep from flowing – its resistance to flowing – is called its viscosity.
- The greater the viscosity, the slower the liquid moves.
- The viscosity of a liquid usually decreases when it is heated.

Conductivity

- A material's ability to allow heat or energy to flow is called conductivity.
- Materials that have a high conductivity, such as metals, are called conductors.

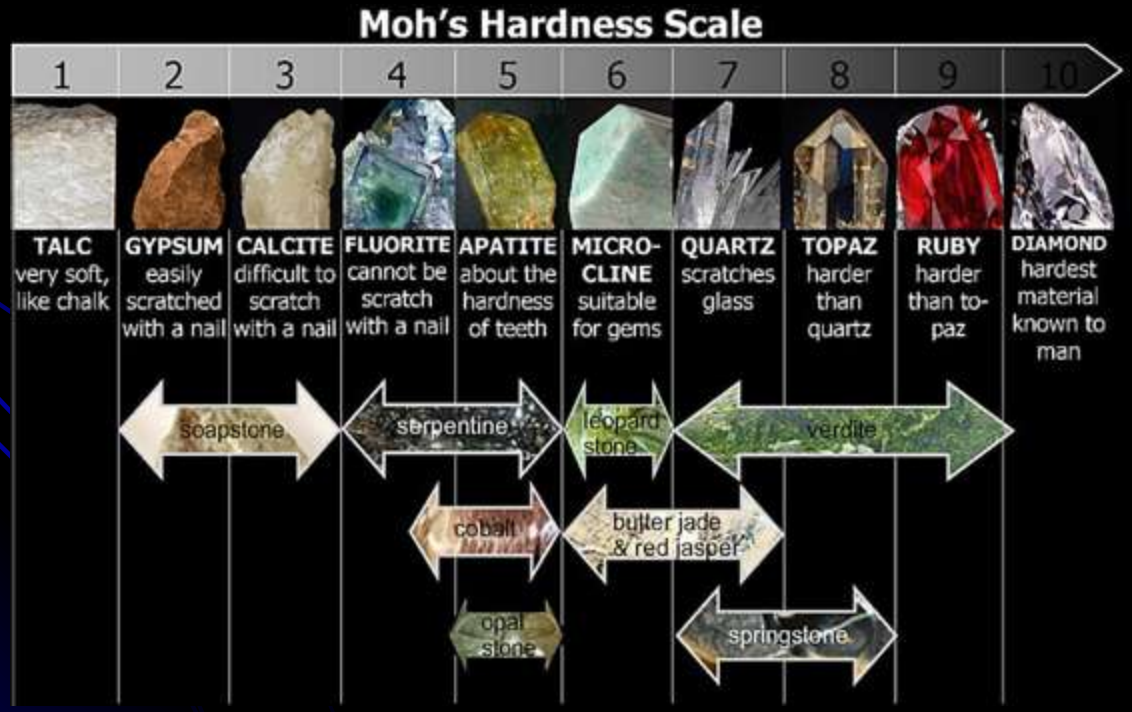


Malleability

- Malleability is the ability of a solid to be hammered without shattering.
- Most metals are malleable.
- Solids that shatter when struck are brittle.

Hardness

- One way to compare the hardness of two materials is to see which of the materials can scratch the other.
- Diamond is the hardest known material.

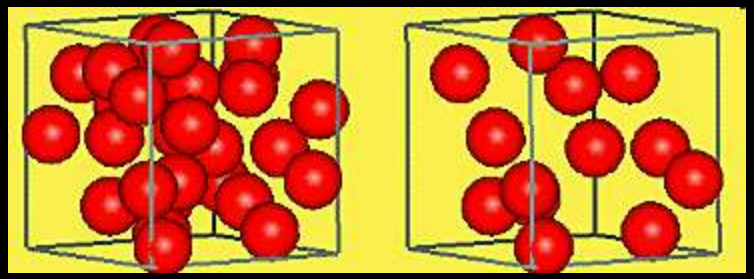


Melting and Boiling Points

- The temperature at which a substance changes from a solid to a liquid is its melting point.
- The temperature at which a substance's internal pressure equals external pressure is its boiling point.

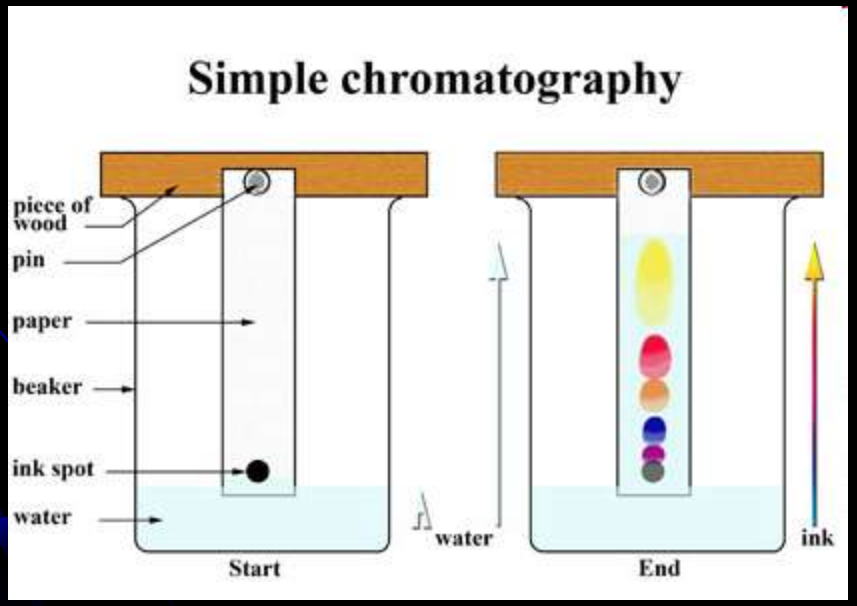
Density

- Density is the ratio of the mass of a substance to its volume.



Physical Properties

- Physical properties are used to identify a material, to choose a material for a specific purpose, or to separate the substances in a mixture.

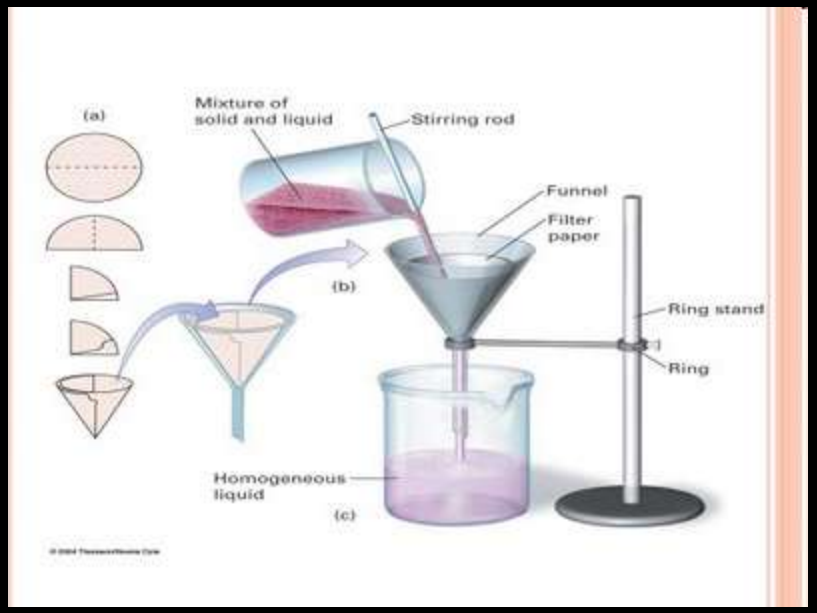


Separating Mixtures

- Filtration and distillation are two common separation methods.

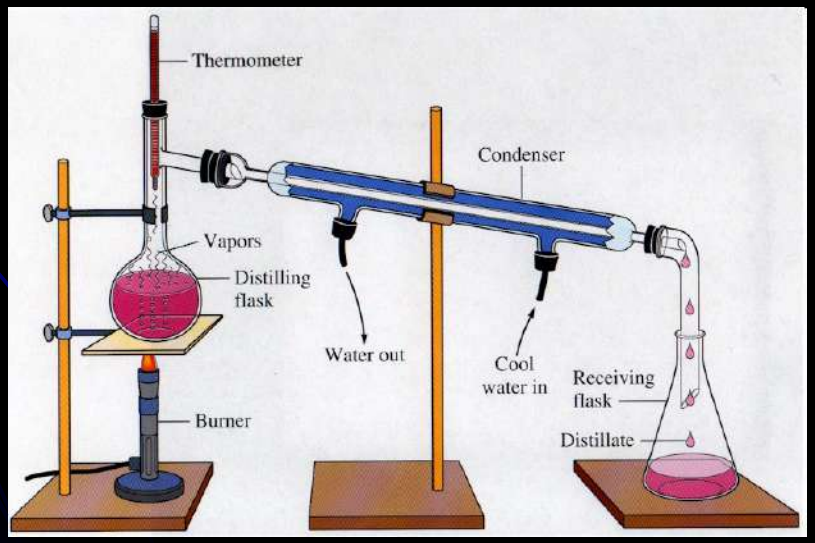
Filtration

- Filtration is a process that separates materials based on the size of their particles.
- Filtration is most commonly used to separate a solid from a liquid.



Distillation

- Distillation is a process that separates the substances in a solution based on their boiling points.
- Distillation is commonly used to separate liquids and to separate solids that are dissolved in liquids.



Physical Changes

- A physical change occurs when some of the properties of a material change, but the substances in the material remain the same.
- Physical changes can be reversible or irreversible.

melting icecutting paper

Section 2.2 Assessment

- List seven examples of physical properties.
- Describe three uses of physical properties.
- Name two processes that are used to separate mixtures.
- When you describe a liquid as thick, are you saying that is has a high or low viscosity?
- Explain why sharpening a pencil is an example of a physical change.

Section 2.2 Assessment

- How could you find out whether copper is harder or softer than plastic?
- Why would you expect the materials used to make pot holders to be poor conductors of heat?
- Silicon dioxide is a solid at room temperature and methanol is a liquid. Which substance has the higher melting point?

Section 2.3 – Chemical Properties

- A chemical property is any ability to produce a change in the composition of matter.
- Chemical properties can be observed only when the substances in a sample of matter are changing into different substances.
- Flammability and reactivity are two examples of chemical properties.

Flammability

- Flammability is the ability to burn in the presence of oxygen.

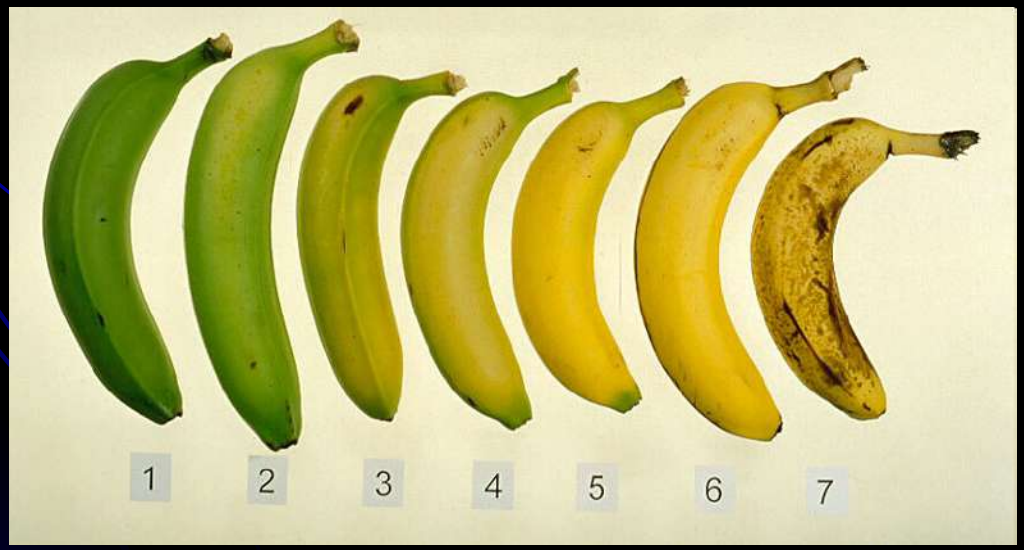
Reactivity

- The property that describes how readily a substance combines chemically with other substances is reactivity.

Chemical Changes

- A chemical change occurs when a substance reacts and forms one or more new substances.
- Three common types of evidence for a chemical change are a change in color, the production of a gas, and the formation of a precipitate.

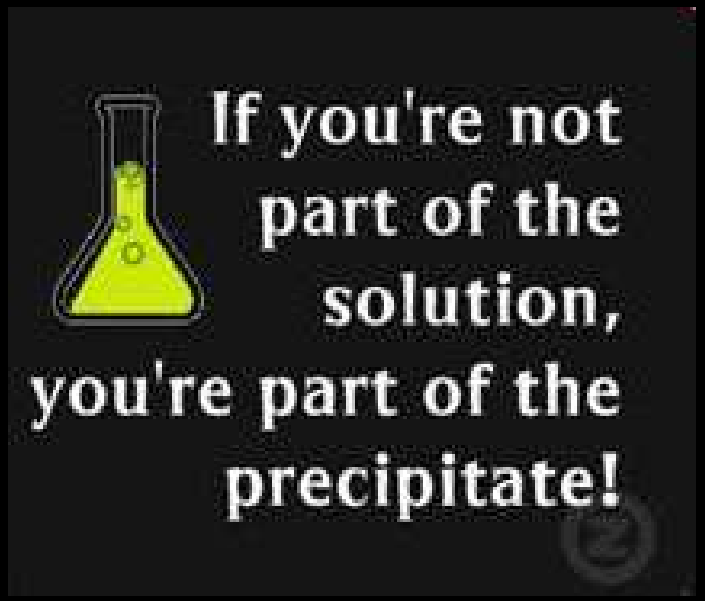
Change in Color



Production of a Gas

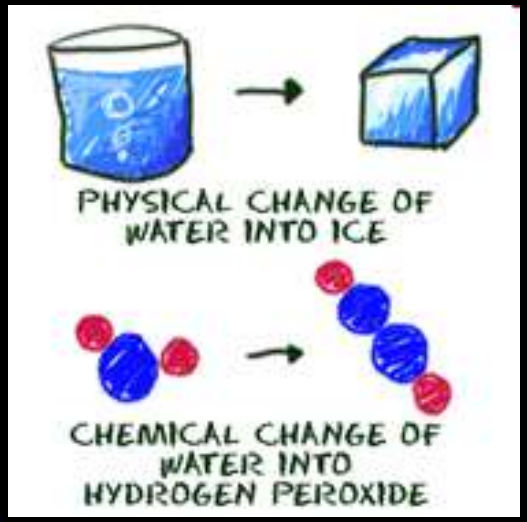
Formation of a Precipitate

- Any solid that forms and separates from a liquid mixture is called a precipitate.



Chemical or Physical?

- When matter undergoes a chemical change, the composition of the matter changes. When matter undergoes a physical change, the composition of the matter remains the same.



Section 2.3 Assessment

- Under what conditions can chemical properties be observed?
- List three common types of evidence for a chemical change.
- How do chemical changes differ from physical changes?
- A pat of butter melts and then burns in a hot pan. Which of these changes is physical and which is chemical?

Section 2.3 Assessment

- If you spill household bleach on denim jeans, you will observe that the area of the spill no longer has a blue color. Is this change chemical or physical?
- Gold and platinum are often used to make jewelry. What can you infer about the reactivity of these elements?