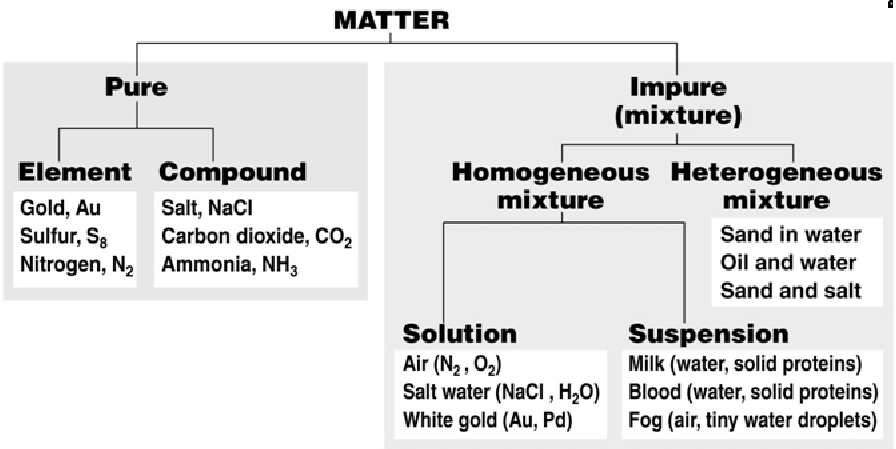
CH. 4: ELEMENTS, COMPOUNDS, MIXTURES

Ms. Liu

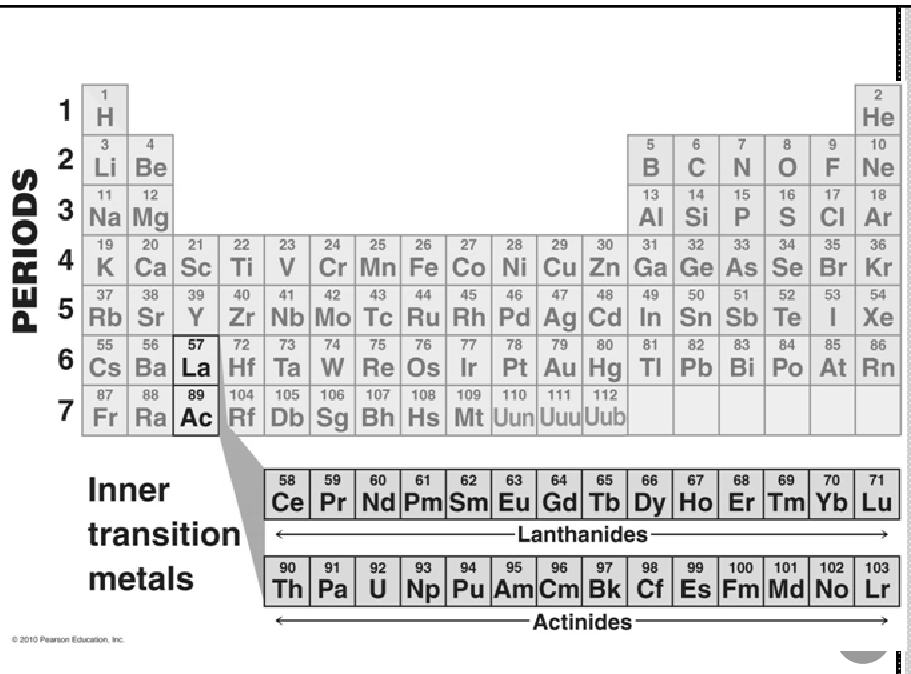
7th Grade Physical Science



4.1 ELEMENTS

- Element
  - A type of atom
  - Pure substance that cannot be broken down into a simpler thing. (gold nugget)
  - Examples:

- Pure substance = something made of only one type of particle.
  - Examples:



4.1 ELEMENTS

- Element
  - A type of atom
  - Pure substance that cannot be broken down into a simpler thing. (gold nugget)
  - Examples: Gold, silver, anything on the periodic table.

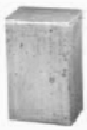
- Pure substance = something made of only one type of particle.
  - Examples: Water is a pure substance, but it is not an element.

- Characteristic property
  - Helps identify an element or pure substance
  - Boiling point, melting point, density, reactivity…

Cobalt

- Melting point: 1,495°C
- Density: 8.9 g/cm³
- Conducts electric current and heat energy
- Unreactive with oxygen in the air

Iron



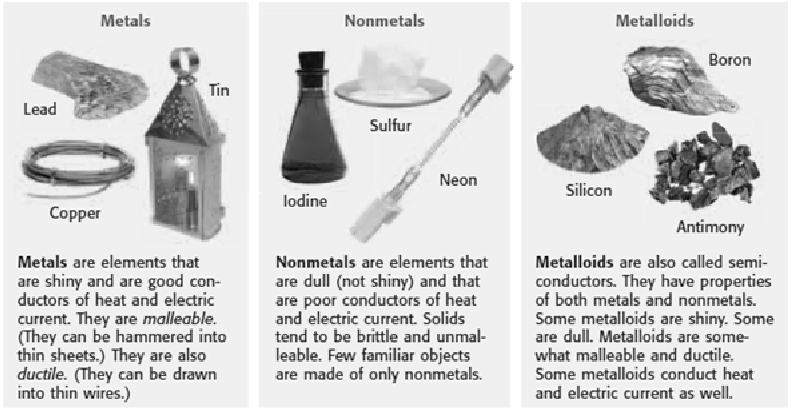
- Melting point: 1,535°C
- Density: 7.9 g/cm³
- Conducts electric current and heat energy
- Combines slowly with oxygen in the air to form rust

Nickel

- Melting point: 1,455°C
- Density: 8.9 g/cm³
- Conducts electric current and heat energy
- Unreactive with oxygen in the air

3 MAJOR TYPES OF ELEMENTS

- Metal: element that is shiny, good conductor
- Nonmetal: element that is dull, poor conductor
- Metalloid (semiconductor): element with properties of both metal and nonmetal
  - Silicon carbide, germanium, gallium arsenide



4.2 COMPOUNDS

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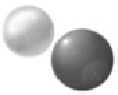
- Element = type of atom



- Compound = molecule
  - 2 or more elements chemically combined

  - When 2 atoms come together or separate, this is called a chemical reaction
  - Ratio of element masses are constant in a compound
    - H_2O hydrogen:oxygen = 1:8

Figure 1 *As magnesium burns, it reacts with oxygen and forms the compound magnesium oxide.*

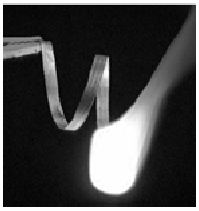
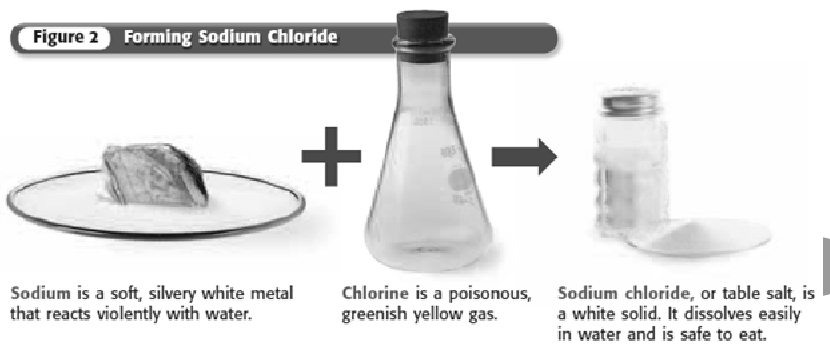


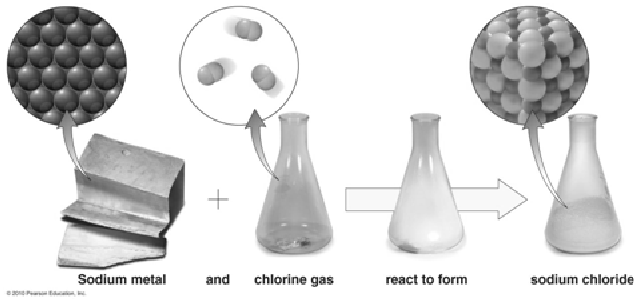
Table 1 Familiar Compounds	
Compound	**Elements combined**
Table salt	sodium and chlorine
Water	hydrogen and oxygen
Vinegar	hydrogen, carbon, and oxygen
Carbon dioxide	carbon and oxygen
Baking soda	sodium, hydrogen, carbon, and oxygen

- Compound = 2 or more elements combined.
- Salt = NaCl (sodium + chloride)
  - What are some properties of salt?
  - Do you think the properties of sodium and chloride are same or different?

4.2 Compound Properties

- Each compound has its own physical and chemical properties, completely different from the elements it's made of!

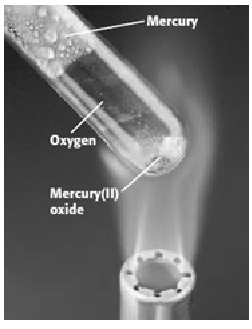




- A compound can be broken down into what 2 types of substances?

- A compound can be broken down into what 2 types of substances?
  - Elements
  - A simpler compound

- How to break down compounds
  - You need a chemical reaction
  - Add energy: heat up, apply electric current (electrolysis)



COMPOUNDS IN YOUR WORLD

- Aluminum oxide → aluminum + oxygen
  - Aluminum: cans, airplanes
- Ammonia = nitrogen + hydrogen
  - Fertilizer
- All living things need protein, which requires nitrogen compounds
- Carbon dioxide is used in photosynthesis
- Carbohydrates

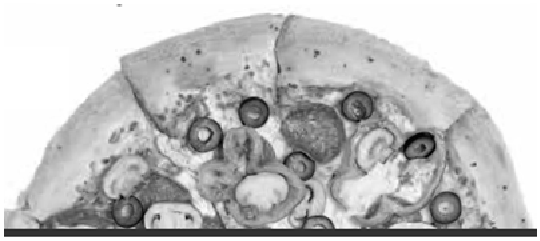
CLASSWORK

Sections 4.1~4.2

4.3 MIXTURES

4.3 MIXTURES

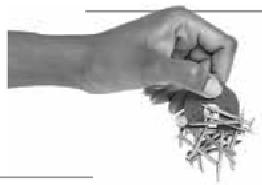
- Mixture = substances combined non-chemically
  - Pizza: cheese is still cheese, tomatoes, etc.



- How do you separate mixtures?
  - Through physical methods!
  - Pizza: pick mushrooms out
  - Saltwater: Evaporate the water, leave the salt.

Figure 2 Common Ways to Separate Mixtures

Distillation (DIS tuh LAY shuhn) is a process that separates a mixture based on the boiling points of the components. Here, pure water (at right) is being distilled from a salt-water mixture (at left). Distillation is also used to separate crude oil into components, such as gasoline and kerosene.



A magnet can be used to separate a mixture of the elements iron and aluminum. Iron is attracted to the magnet, but aluminum is not.

The different parts of blood are separated using a machine called a centrifuge (SEN truh FYOOJ). In the test tube at left, a layer of plasma rests above a layer of red blood cells. A centrifuge separates mixtures by the densities of the components.

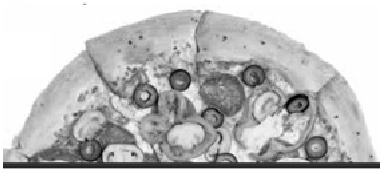
Separating a mixture of sodium chloride (table salt) and sulfur takes more than one step.

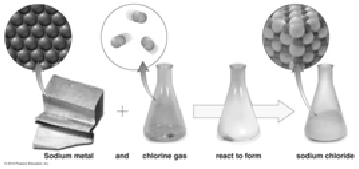
❶ In the first step, water is added, and the mixture is stirred. Salt dissolves in water. Sulfur does not.

❷ In the second step, the mixture is poured through a filter. The filter traps the solid sulfur.

❸ In the third step, the water is evaporated. The sodium chloride is left behind.

Table 1 Mixtures and Compounds	
Mixtures	**Compounds**
Made of elements, compounds, or both	Made of elements
No change in original properties of components	Change in original properties of components
Separated by physical means	Separated by chemical means
Formed using any ratio of components	Formed using a set ratio of components



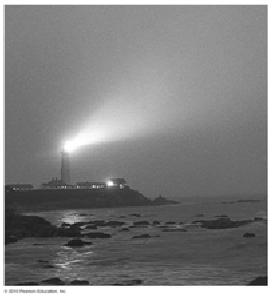


MIXTURE RATIO – NOT CONSTANT

Figure 3 *These paperweights are made of granite. They are different colors because the granite used in each has different ratios of minerals.*

4.3 SOLUTION

- Solution = a mixture of tiny particles evenly spread out
  - So tiny that there is no scattering of light
- Which is a solution?



4.3 SOLUTION

- A solution is made of a solute dissolved in a solvent.
  - Solute = the thing that is dissolved
  - Solvent = the thing that does the dissolving
    - Solid in solid: The one that you have more of
  - Saltwater: The solvent is _____. The solute is _____.
- A solution does not need to be in a liquid!

Table 2 **Examples of Different States in Solutions**

States	Examples
Gas in gas	dry air (oxygen in nitrogen)
Gas in liquid	soft drinks (carbon dioxide in water)
Liquid in liquid	antifreeze (alcohol in water)
Solid in liquid	salt water (salt in water)
Solid in solid	brass (zinc in copper)

alloy

4.3 SOLUTION

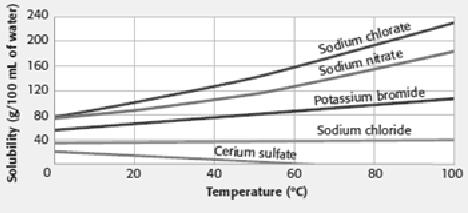
- Concentration (g/mL) = how much solute is dissolved in the solvent
- Which one is more concentrated? Which one is more dilute?

4.3 SOLUTION

- What happens when you mix too much sugar in lemonade?
- Solubility = ability of substance to dissolve at a certain temperature

Figure 6 Solubility of Different Solids in Water

The solubility of most solids increases as the temperature gets higher. So, more solute can dissolve at higher temperatures. However, some solids, such as cerium sulfate, are less soluble at higher temperatures.



4.3 SOLUTION

MATH FOCUS

Calculating Concentration What is the concentration of a solution that has 35 g of salt dissolved in 175 mL of water?

Step 1: One equation for finding concentration is the following:

$$\text{concentration} = \frac{\text{grams of solute}}{\text{milliliters of solvent}}$$

Step 2: Replace grams of solute and milliliters of solvent with the values given, and solve.

$$\frac{35 \text{ g salt}}{175 \text{ mL water}} = 0.2 \text{ g/mL}$$

Now It's Your Turn

1. What is the concentration of solution A if it has 55 g of sugar dissolved in 500 mL of water?
2. What is the concentration of solution B if it has 36 g of sugar dissolved in 144 mL of water?
3. Which solution is more concentrated?

4.3 SOLUTION

Figure 7 How to Dissolve Solids Faster

Mixing by stirring or shaking causes the solute particles to separate from one another and spread out more quickly among the solvent particles.

Heating causes particles to move more quickly. The solvent particles can separate the solute particles and spread them out more quickly.

Crushing the solute increases the amount of contact it has with the solvent. The particles of the crushed solute mix with the solvent more quickly.

4.3 SUSPENSIONS

- Suspension = mixture where particles are <u>big</u> enough to <u>settle</u> out
  - Can filter out
  - Shake bottle before use: salad dressing, snow globe

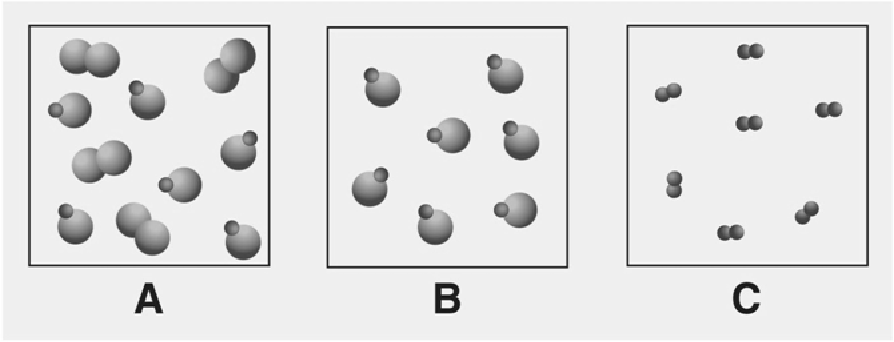
Suspension This snow globe contains solid particles that will mix with the clear liquid when you shake it up. But the particles will soon fall to the bottom when the globe is at rest.

4.3 COLLOID

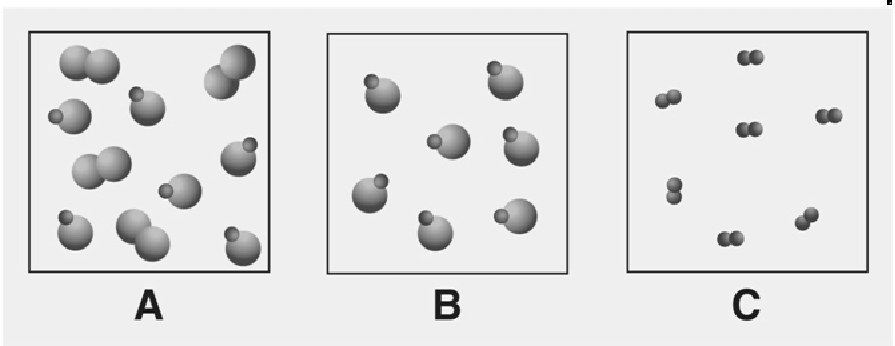
- Colloid = mixture with <u>medium</u>-sized particles that are evenly distributed
  - Cannot filter out
  - Can scatter light
  - Milk, mayonnaise, butter, whipped cream, blood

Colloid This dessert includes two tasty examples of colloids—fruity gelatin and whipped cream.

COMPOUND, MIXTURE, OR ELEMENT?

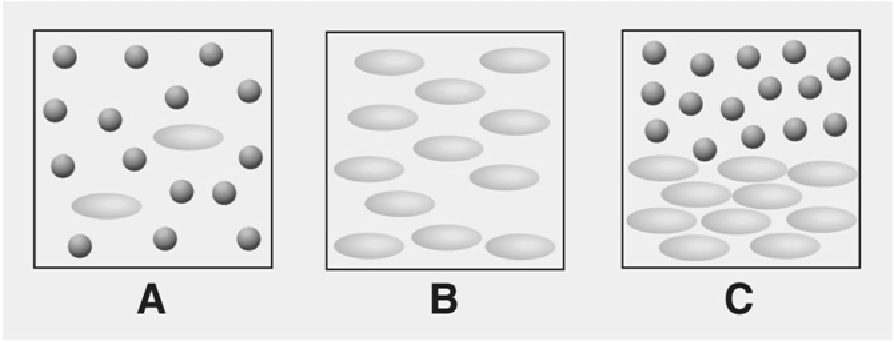


COMPOUND, MIXTURE, OR ELEMENT?

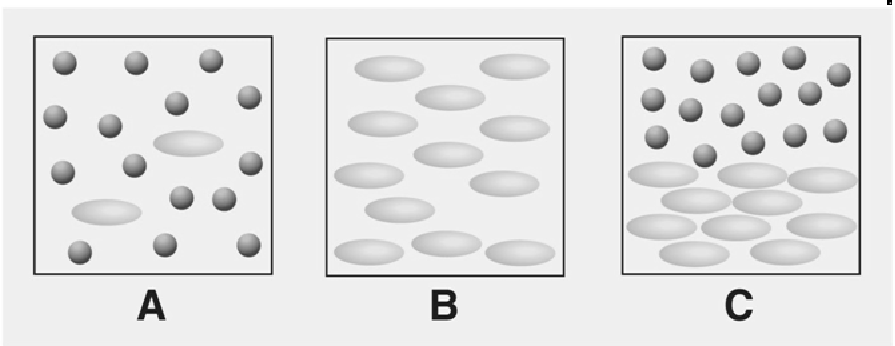


- Mixture compound element

SUSPENSION, SOLUTION, OR COMPOUND?



SUSPENSION, SOLUTION, OR COMPOUND?

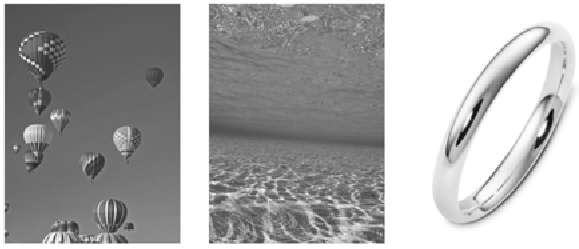


- Solution
- compound
- suspension

SOLUTION, COLLOID, OR SUSPENSION?

Granite "Snow" in snow globe Pizza

(a) Heterogeneous mixtures



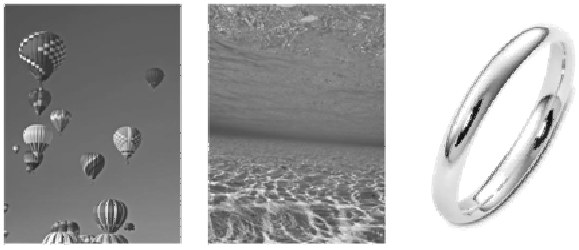
Air Clear seawater White gold

(b) Homogeneous mixtures

SOLUTION, COLLOID, OR SUSPENSION?

Granite "Snow" in snow globe Pizza

(a) Heterogeneous mixtures



Air Clear seawater White gold

(b) Homogeneous mixtures

- Mixture
- Suspension
- Mixture

- solutions

CLASSWORK