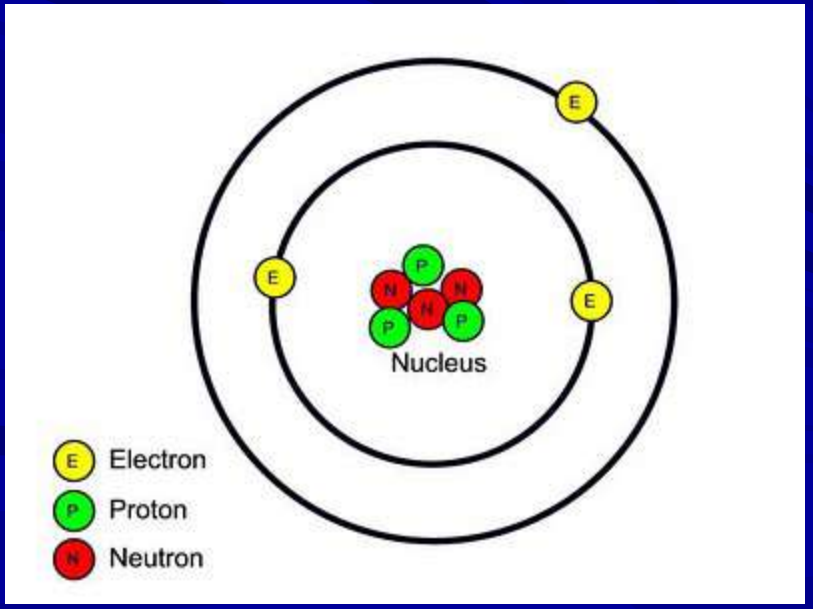
Chapter 2: Matter and Change

By: Jennie Borders

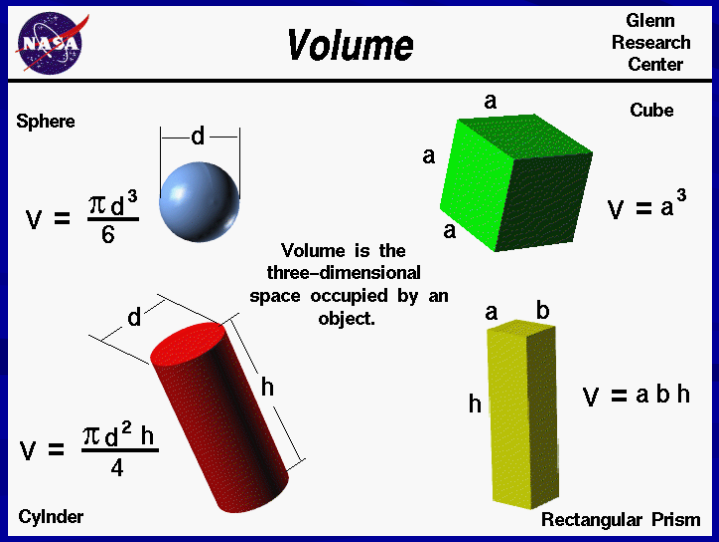
Section 2.1: Properties of Matter

- Matter is anything that has mass and occupies space.
- All matter exists of tiny particles called atoms.



Matter

- The mass of an object is the measure of the amount of matter the object contains.
- The volume of an object is the measure of the space occupied by an object.



Extensive Properties

- An extensive property is a property that depends on the amount of matter in a sample.
- Examples: mass and volume

Intensive Properties

- An intensive property is a property that depends on the type of matter, not the amount of matter.
- Examples: density and hardness

Substances

- A substance is a type of matter with a uniform composition.
- Examples: water and gold

Physical Properties

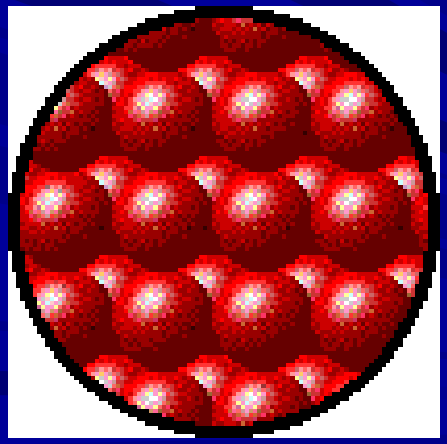
- Physical properties are characteristics of a substance that can be observed without the substance changing composition.
- Examples: boiling point and color

Physical Changes

- A physical change involves a change in one or more physical properties, but no change in the chemical composition of the substance.
- Examples: melting and cutting
- Physical changes can be reversible or irreversible.

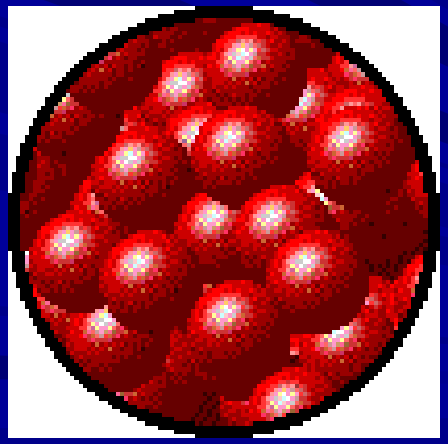
States of Matter

- A solid is a state of matter that has a definite shape and volume.
- Solids are not easily compressed.



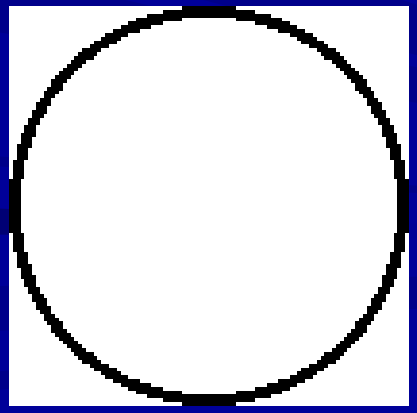
States of Matter

- A liquid has a definite volume, but it takes the shape of its container.
- Liquids are not easily compressed.

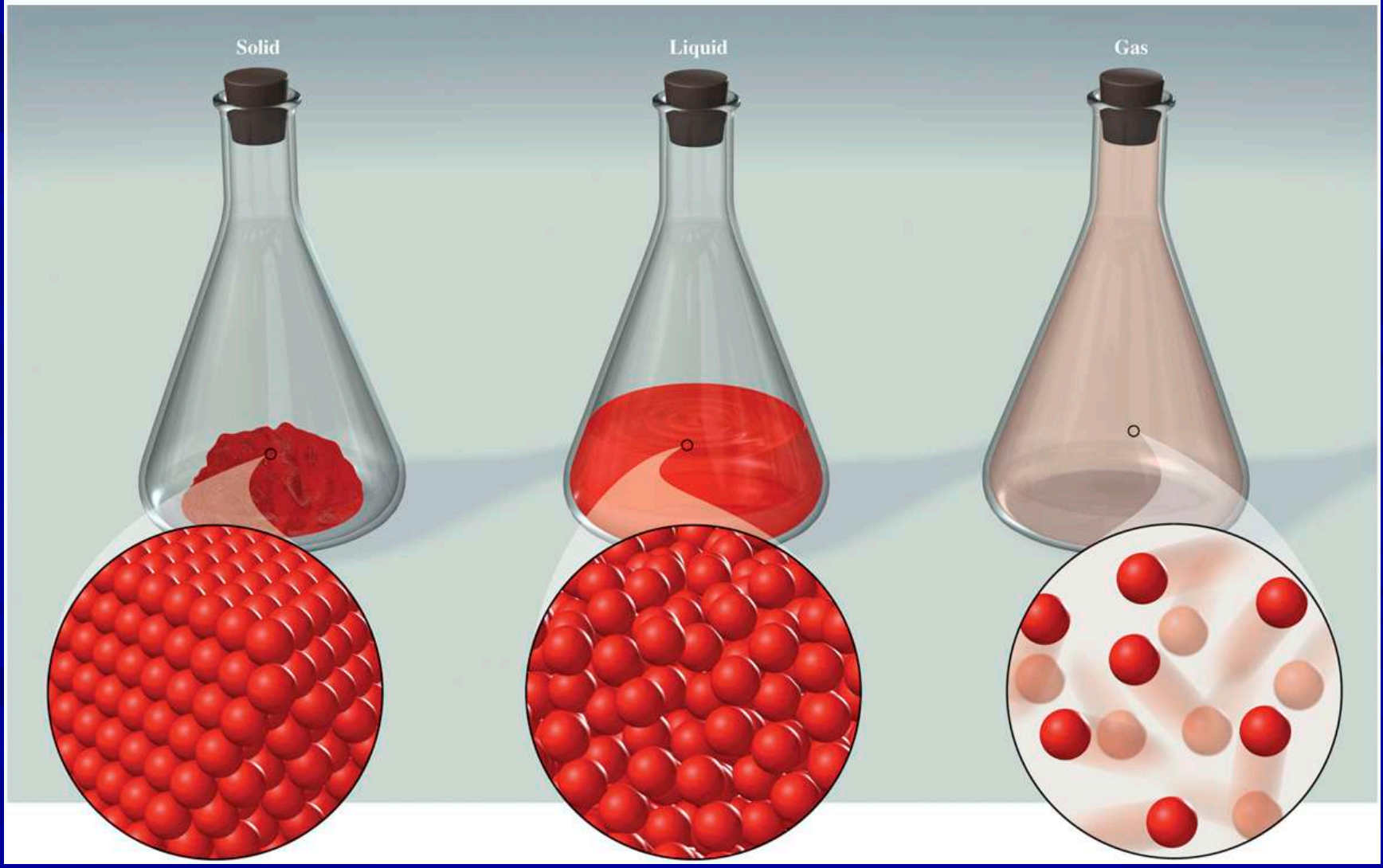


States of Matter

- A gas has no fixed volume or shape.
- Gases can be compressed.
- A vapor is the gaseous state of a substance that is generally a solid or a liquid at room temperature.
- Examples: oxygen = gas, steam = vapor

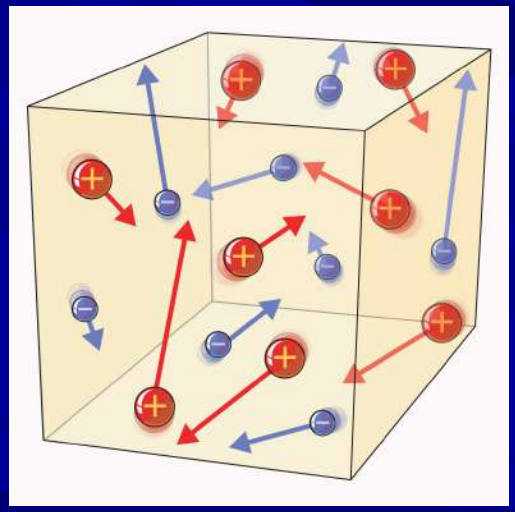


Solid, Liquid, and Gas



States of Matter

- A plasma is an ionized gas-like phase consisting of electrons and positive ions.



Section 2.1 Assessment

- Name two categories used to classify properties of matter.
- Explain why all sample of a given substance have the same intensive properties.
- Name four states of matter.
- Describe the two categories used to identify physical changes.

Section 2.1 Assessment

- In what ways are liquids and gases alike? In what ways are liquids and solids different?
- Is the freezing of mercury a reversible or irreversible physical change?

Section 2.2: Mixtures

- A mixture is a material of variable composition that contains two or more substances.
- Examples: salad and sweet tea
- An alloy is a mixture that has metallic properties.
- Example: sterling silver – silver and copper

Heterogeneous Mixtures

- A heterogeneous mixture is a mixture that has different properties in different parts of the mixture.
- Examples: chocolate chip cookies and vegetable soup

Homogeneous Mixtures

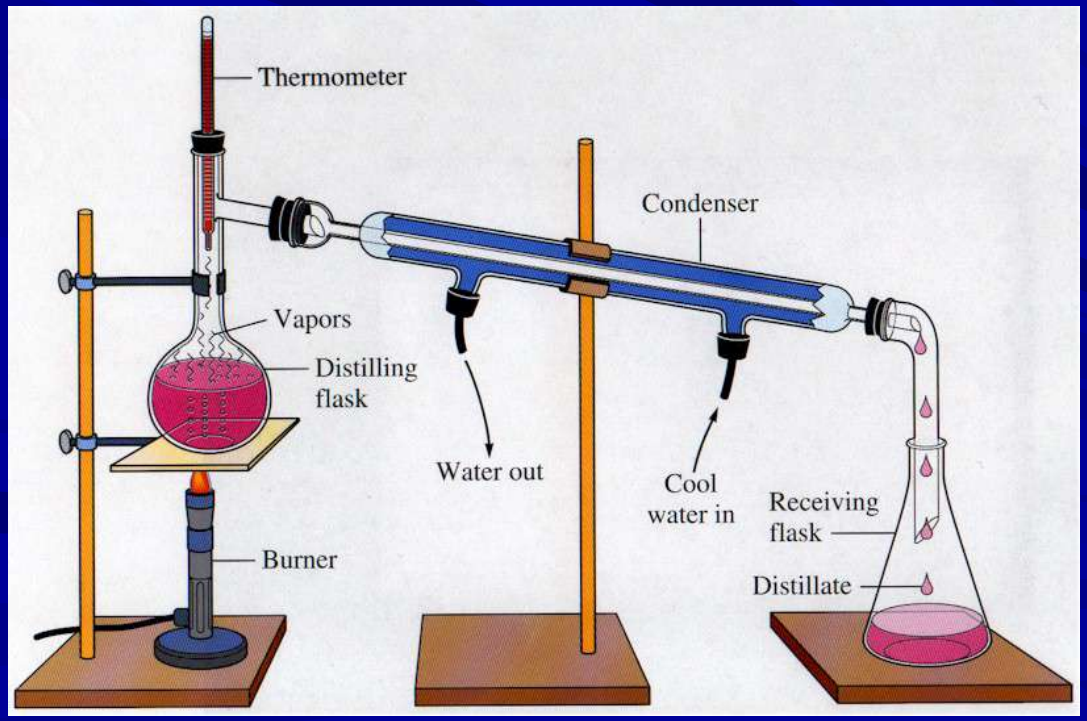
- A homogeneous mixture is a mixture that has a uniform composition. It is also called a solution.
- Examples: Coke and Windex

Separating Mixtures

- Filtration is a method for separating components of a mixture containing a solid and a liquid.

Separating Mixtures

- Distillation is a method for separating the components of a mixture based on the different boiling points of the components.



Section 2.2 Section Assessment

- How are mixtures classified?
- Classify each of the following as a homogeneous or heterogeneous mixture.
  a. food coloring
  b. ice cubes in liquid water
  c. mouthwash
  d. mashed, unpeeled potatoes
- How are a substance and a solution similar? How are they different?

Section 2.2 Assessment

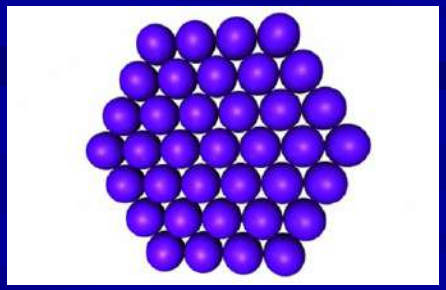
- In general, when would you use filtration to separate a mixture? When would you use distillation to separate a mixture?
- Describe a procedure that could be used to separate a mixture of sand and table salt.

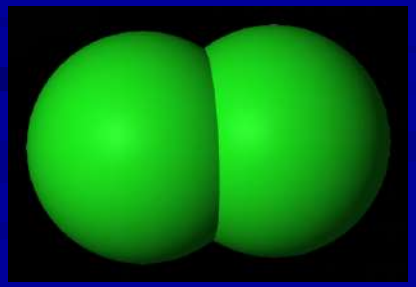
Section 2.3: Elements and Compounds

- An atom is the smallest part of an element that retains its identity in a chemical reaction.
- Examples: sulfur = S, sodium = Na
- Molecules are a bonded collection of two or more atoms of the same element or of different elements.
- Examples: water = H_2O, oxygen = O_2

Elements

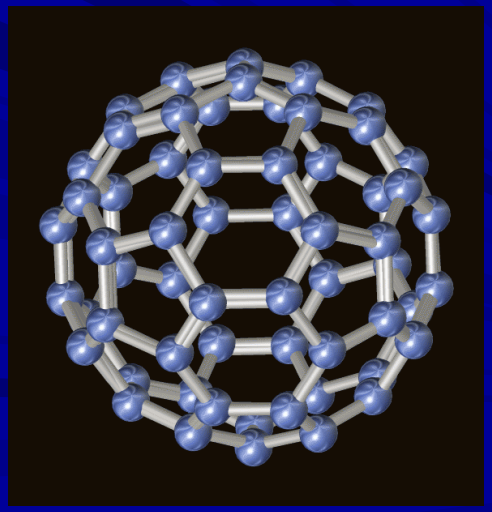
- Elements are substances that cannot be broken down into simpler substances by chemical or physical means. It consists of atoms with the same atomic number.
- Elements are made of atoms or molecules.
- Examples: tin = Sn, fluorine = F_2





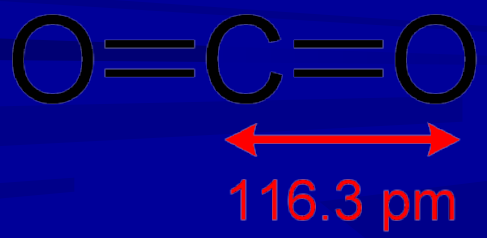
Allotropes

- Allotropes are different forms of a given element.
- Example: carbon – diamond, graphite, and buckminsterfullerene

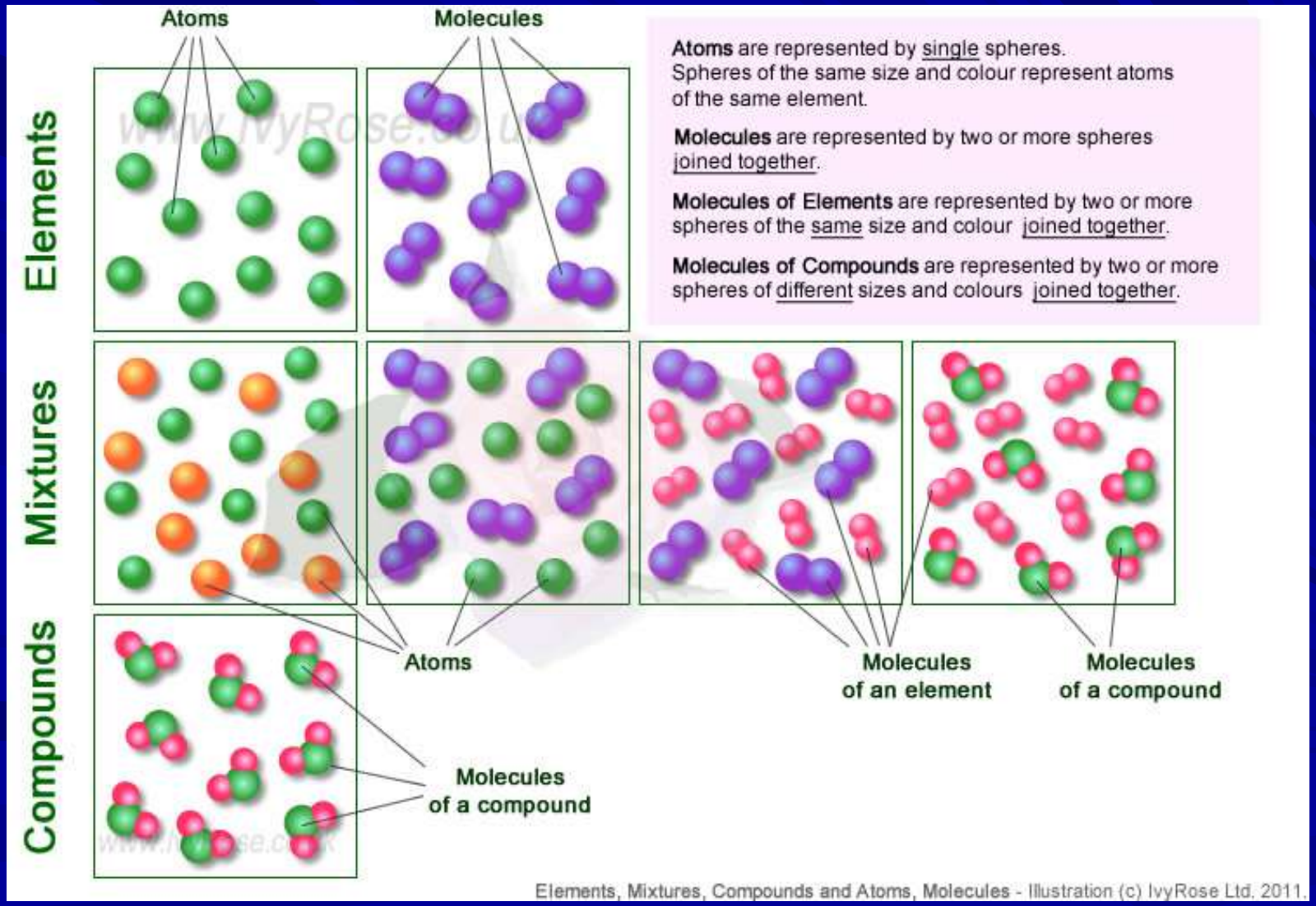


Compounds

- Compounds are substances made from two or more elements chemically combined in a fixed proportion.
- Compounds can be broken down into its elements by chemical processes.
- Compounds are made up of molecules.
- Examples: carbon dioxide = CO_2, sodium chloride = NaCl

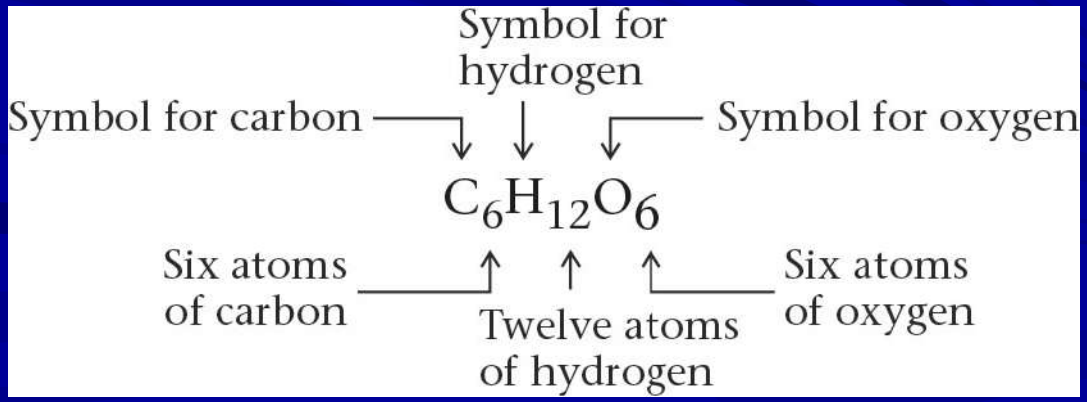


Elements, Compounds, and Mixtures



Chemical Formulas

- Each element is represented by a chemical symbol. Only the first letter of the chemical symbol is always capitalized.
- Subscripts represent the number of atoms of each element.
- Example: SiO_2



Section 2.3 Assessment

- How is a compound different from an element?
- How can you distinguish a substance from a mixture?
- Classify each of these samples of matter as an element, a compound, or a mixture.

a. table sugarc. tap water

b. cough syrupd. nitrogen

Section 2.3 Assessment

- Write the chemical symbol for each element.

a. leadd. oxygen

b. silvere. sodium

c. hydrogenf. aluminum

- Name the elements represented by the following symbols.

a. Cd. Au

b. Cae. Fe

c. Kf. Cu

Section 2.4: Chemical Reactions

- A chemical property is the ability of a substance to change to a different substance.
- Examples: flammable and corrosive

Chemical Change

- A chemical change involves a change in the fundamental components of the substance.
- Examples: burn and decompose

Chemical Reactions

- A substance present at the start of a reaction is a reactant.
- A substance produced in the reaction is a product.
- Example: $2H_2 + O_2 \rightarrow 2H_2O$

  reactants product

Five Signs of a Chemical Reaction

- The five signs of a chemical reaction are change in color, production of a gas, change in temperature, production of light, and formation of a precipitate.

Precipitate

- A precipitate is a solid that forms and during a chemical reaction involving a liquid mixture.

Conservation of Mass

- The law of conservation of mass states that in any physical or chemical process, mass is neither created nor destroyed.
- During any chemical reaction, the mass of the products is always equal to the mass of the reactants.

Section 2.4 Assessment

- How does a chemical change affect the composition of matter?
- Name the five signs that a chemical reaction has taken place.
- In a chemical reaction, how does the mass of the reactants compare with the mass of the products?
- What is the main difference between physical and chemical changes?

Section 2.4 Assessment

- Classify the following changes as physical or chemical changes.

a. Water boils.

b. Milk turns sour.

c. Salt dissolves in water.

d. A metal rusts.

- Hydrogen and oxygen react chemically to form water. How much water would form if 4.8g of hydrogen reacted with 38.4g of oxygen?