


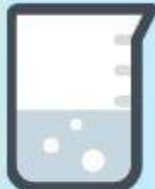









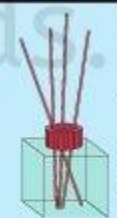







2.1 Properties of Matter >

Matter and Change

2.1 Properties of Matter

Physical Properties of Matter

| | | | | |
|---|---|--|--|--|
| <p>Density sink or float?</p>  | <p>Texture rough</p>   <p>colors</p> | <p>volume</p>   <p>length</p> | <p>melting point</p>  <p>boiling point</p>  |  <p>electrical conductivity</p> |
| <p>Shapes</p>  |  <p>magnetism</p> | <p>solid</p>  <p>liquid</p>  <p>gas</p>  | <p>diffusion</p>  | <p>solubility</p>  |
| <p>mass</p>  | <p>temperature</p>  | <p>states of matter</p> | <p>elasticity</p>  | <p>transparency</p>  |

Why are windows made of glass?

In this lesson, you will learn how properties can be used to classify and identify matter.



Describing Matter

 Why do all samples of a substance have the same intensive properties?

2.1 Properties of Matter > Describing Matter

What you observe when you look at a particular sample of matter is its properties.

- Is a solid shiny or dull?
- Does a liquid flow quickly or slowly?
- Is a gas odorless, or does it have a smell?

2.1 Properties of Matter > Describing Matter

Properties used to describe matter can be classified as extensive or intensive properties.

Extensive Properties

Recall that matter is anything that has mass and takes up space.

- The **mass** of an object is a measure of the amount of matter the object contains.



- The mass of a basketball is greater than the mass of a golf ball.



Extensive Properties

The **volume** of an object is a measure of the space occupied by the object.

- The volume of a basketball is greater than the volume of a golf ball.



Extensive Properties

Mass and volume are both examples of extensive properties.

- An **extensive property** is a property that depends on the amount of matter in a sample.

Intensive Properties

There are properties to consider when selecting a basketball besides mass and volume.

- The outer covering may be made of leather, rubber, or a synthetic composite.
 - Each of these materials has different properties that make the basketballs suitable for different playing situations.



Intensive Properties

For example, leather balls are suitable for indoor play but not outdoor play.

- Leather balls absorb water and dirt more than rubber balls do.

Intensive Properties

Absorbency is an example of an intensive property.

- An **intensive property** is a property that depends on the type of matter in a sample, not the amount of matter.

Identifying a Substance

Each object in this figure has a different chemical makeup, or composition.

- The soda can is mainly aluminum.
- The watering can is mainly copper.




Identifying a Substance

Matter that has a uniform and definite composition is called a **substance**.

- Aluminum and copper are examples of substances, which are also referred to as *pure substances*.

Identifying a Substance

 Every sample of a given substance has identical intensive properties because every sample has the same composition.

Identifying a Substance

Aluminum and copper have some properties in common, but there are differences besides their distinctive colors.

- Aluminum is highly reflective and is often used in silver paint.
- Pure copper can scratch the surface of aluminum because copper is harder than aluminum.
- Copper is a conductor of heat or electric current.
- Copper and aluminum are both malleable, which means they can be hammered into sheets without breaking.

Identifying a Substance

Hardness, color, conductivity, and malleability are examples of physical properties.

- A **physical property** is a quality or condition of a substance that can be observed or measured without changing the substance's composition.

2.1 Properties of Matter >

Interpret Data

This table lists physical properties for some substances.

Physical Properties of Some Substances

| Substance | State | Color | Melting point (° C) | Boiling point (° C) |
|-----------------|--------|-----------------|---------------------|---------------------|
| Neon | Gas | Colorless | -249 | -246 |
| Oxygen | Gas | Colorless | -218 | -183 |
| Chlorine | Gas | Greenish-yellow | -101 | -34 |
| Ethanol | Liquid | Colorless | -117 | 78 |
| Mercury | Liquid | Silvery-white | -39 | 357 |
| Bromine | Liquid | Reddish-brown | -7 | 59 |
| Water | Liquid | Colorless | 0 | 100 |
| Sulfur | Solid | Yellow | 115 | 445 |
| Sodium chloride | Solid | White | 801 | 1413 |
| Gold | Solid | Yellow | 1064 | 2856 |
| Copper | Solid | Reddish-yellow | 1084 | 2562 |

- The states of the substances are given at room temperature.

Identifying a Substance

Physical properties can help chemists identify substances.

- For example, a colorless substance that was found to boil at 100°C and melt at 0°C would likely be water.
- A colorless substance that boiled at 78°C and melted at -117°C would definitely not be water. It would likely be ethanol.

Glass is often used to make windows, while copper is often used in electrical wires. What properties of glass make it a desirable material to use for windows?

Glass is often used to make windows, while copper is often used in electrical wires. What properties of glass make it a desirable material to use for windows?

Glass is transparent, so it can be seen through; hard, so it stays in place within window frames; and heat resistant, so it helps prevent the transfer of heat between outside and inside.



You want to compile a list of properties of a substance, but you don't have a way to measure mass or volume. What kinds of properties can you determine without knowing the amount of matter in the sample?



You want to compile a list of properties of a substance, but you don't have a way to measure mass or volume. What kinds of properties can you determine without knowing the amount of matter in the sample?

You can determine the sample's intensive properties.

States of Matter

 What are three states of matter?

2.1 Properties of Matter > States of Matter

Depending on the circumstances, you use three different words to refer to water—water, ice, and steam.

- Water, which is a common substance, exists in three different physical states.
 - So can most other substances.

2.1 Properties of Matter > States of Matter

 Three states of matter are solid, liquid, and gas.

Solids

A **solid** is a form of matter that has a definite shape and volume.

- The shape of a solid doesn't depend on the shape of its container.

Solids

A **solid** is a form of matter that has a definite shape and volume.

- The shape of a solid doesn't depend on the shape of its container.
- The particles in a solid are packed tightly together, often in an orderly arrangement.



Solids

A **solid** is a form of matter that has a definite shape and volume.

- As a result, solids are almost incompressible; that is, it is difficult to squeeze a solid into a smaller volume.
- In addition, solids expand only slightly when heated.

Liquids

The particles in a liquid are in close contact with one another, but the arrangement of particles in a liquid is not rigid or orderly.



Liquids

The particles in a liquid are in close contact with one another, but the arrangement of particles in a liquid is not rigid or orderly.

- Because the particles in a liquid are free to flow, a liquid takes the shape of the container in which it is placed.



Liquids

The particles in a liquid are in close contact with one another, but the arrangement of particles in a liquid is not rigid or orderly.

- However, the volume of the liquid doesn't change as its shape changes.



Liquids

The volume of a liquid is fixed or constant.

- Thus, a **liquid** is a form of matter that has an indefinite shape, flows, and yet has a fixed volume.

Liquids

The volume of a liquid is fixed or constant.

- Thus, a **liquid** is a form of matter that has an indefinite shape, flows, and yet has a fixed volume.
 - Liquids are almost incompressible.
 - However, they tend to expand slightly when heated.

Gases

- Like a liquid, a gas takes the shape of its container.
- But, unlike a liquid, a gas can expand to fill any volume.

2.1 Properties of Matter > States of Matter

Gases

A **gas** is a form of matter that takes both the shape and volume of its container.



Gases

A **gas** is a form of matter that takes both the shape and volume of its container.

- The particles in a gas are usually much farther apart than the particles in a liquid.



Gases

A **gas** is a form of matter that takes both the shape and volume of its container.

- The particles in a gas are usually much farther apart than the particles in a liquid.
- Because of the space between particles, gases are easily compressed into a smaller volume.



Gases

The words *vapor* and *gas* are sometimes used interchangeably. But there is a difference.

- The term *gas* is used for substances, like oxygen, that exist in the gaseous state at room temperature.
- **Vapor** describes the gaseous state of a substance that is generally a liquid or solid at room temperature, as in *water vapor*.



A substance is in a state in which it takes the shape of its container. What state or states could it be in?



A substance is in a state in which it takes the shape of its container. What state or states could it be in?

The substance could be either a liquid or a gas, as each takes the shape of its container.

Physical Changes



How can physical changes be classified?

2.1 Properties of Matter > Physical Changes



The melting point of gallium metal is 30°C . The figure at left shows how the heat from a person's hand can melt a sample of gallium.

2.1 Properties of Matter > Physical Changes

The shape of the sample changes during melting as the liquid begins to flow, but the composition of the sample does not change.

- Melting is a physical change.
- During a **physical change**, some properties of a material change, but the composition of the material does not change.

2.1 Properties of Matter > Physical Changes

- Words such as *boil*, *freeze*, *melt*, and *condense* are used to describe physical changes.
- So are words such as *break*, *split*, *grind*, *cut*, and *crush*.
 - There is a difference between these two sets of words. Each set describes a different type of physical change.



Physical changes can be classified as reversible or irreversible.

- Melting is an example of a reversible physical change.
 - If a sample of liquid gallium cools below its melting point, the liquid will become solid.

2.1 Properties of Matter > Physical Changes

All physical changes that involve a change from one state to another are reversible.

- Cutting hair, filing nails, and cracking an egg are examples of irreversible physical changes.



**Water boils and becomes water vapor.
Is this a reversible or irreversible
physical change?**



**Water boils and becomes water vapor.
Is this a reversible or irreversible
physical change?**

It is a reversible physical change because it involves a change from one state to another.

2.1 Properties of Matter > Key Concepts



Every sample of a given substance has identical intensive properties because every sample has the same composition.



Three states of matter are solid, liquid, and gas.



Physical changes can be classified as reversible or irreversible.

2.1 Properties of Matter > Glossary Terms

- **mass**: a measure of the amount of matter that an object contains; the SI base unit of mass is the kilogram
- **volume**: a measure of the space occupied by a sample of matter
- **extensive property**: a property that depends on the amount of matter in a sample
- **intensive property**: a property that depends on the type of matter in a sample, not the amount of matter

- **substance**: matter that has a uniform and definite composition; either an element or a compound; also called pure substance
- **physical property**: a quality or condition of a substance that can be observed or measured without changing the substance's composition
- **solid**: a form of matter that has a definite shape and volume
- **liquid**: a form of matter that flows, has a fixed volume, and has an indefinite shape

- **gas**: a form of matter that takes the shape and volume of its container; a gas has no definite shape or volume
- **vapor**: describes the gaseous state of a substance that is generally a liquid or solid at room temperature
- **physical change**: a change during which some properties of a material change, but the composition of the material does not change

2.1 Properties of Matter >

Matter

Anything that **takes up space** and displays the properties of **mass and inertia**

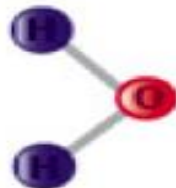
2 parts/components

Composition

Components of a sample and their relative proportions

Example: Water/H₂O

Components: Hydrogen and Oxygen
[2 parts Hydrogen, 1 part Oxygen]



Properties

Distinguishing qualities or attributes of a sample of matter

Example: banana

Color: yellow/green

Texture: squishy/soft

Changes: browning



2.1 Properties of Matter > 5 Signs of a Chemical Change

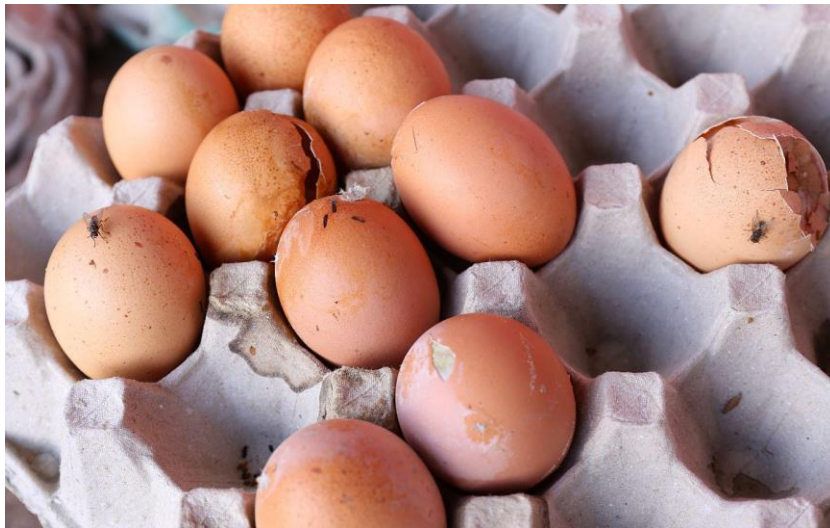
The only sure way to know there has been a chemical change is the observance of a new substance formed

Sometimes that is hard to do, so look for the signs.....

2.1 Properties of Matter > Sign 1 a Chemical Change

Odor Production-this is an odor far different from what it should smell like

Ex: Rotting eggs, food in fridge, decomposing meat



2.1 Properties of Matter > 2nd Sign of a Chemical Change

Change in Temperature

Exothermic-When energy is released do during the chemical change ex: wood burning



2.1 Properties of Matter >

Change in Temperature

Endothermic- Energy is absorbed causing a decrease in temperature of the reactant material ex: cold pack in first aid kit



2.1 Properties of Matter >

3rd Sign of a Chemical Change

Change in Color

Ex: fruit changing color when it ripens, leaves changing color in the Autumn



2.1 Properties of Matter >

4th sign of a Chemical Change

Formation of Bubbles

This can indicate the presence of a gas.

Bubbles produced when boiling water is not a chemical change.



2.1 Properties of Matter > 5th Sign of a Chemical Change

Formation of a Precipitate

When two liquids are combined and a solid is produced



2.1 Properties of Matter >

Put the following materials and objects into the column of their natural state of matter.

Rock

Pepsi

Carbon Dioxide

Lightning

Blood

breath

Smell of popcorn

Fire Flames

Air

Nitrogen

Water

Vinegar

Rope

Electric sparks

Tomato juice

Football

Vacuum cleaner

Milk

Hydrogen

Steam

Chicken

Sand

Spit

Rain

Crayola

Spoon

Sun's corona

Beer

Brick

Laser light

Wire

Sweat

Oxygen

Smoke

Car exhaust

Aurora Borealis

SOLID

LIQUID

GAS

PLASMA