The Properties of Matter

Chapter 2

What do the following objects have in common?

What do the following objects have in common?

- Give up?
- They are all made up of atoms and molecules, which means, they are all types of **matter**.
- So basically, everything in the universe is matter.
- Cupcakes are matter, baby elephants are matter, 8th graders are matter.
- Matter is everything around you.

More Matter

- Matter is anything made of atoms and molecules.
- As of 1995, scientists have identified **five** states of matter - we will talk about these later.
- Matter is also anything that has **volume** and **mass**.

Matter is made up of atoms!

- All matter is the same because all matter is made up of atoms.
- Matter is also different because objects can be made up of different kinds of atoms.
- Gold is made of one kind of atom-gold atoms.
- Salt is made up of two different kinds of atoms-sodium atoms and chloride atoms.

Objects have mass. (WRITE THIS)

- Mass is how much there is of an object.
- Mass is related to how much something weighs.
- Mass and weight are two different things.
- The unit for mass is a gram.
- A nickel has the mass of about one gram.

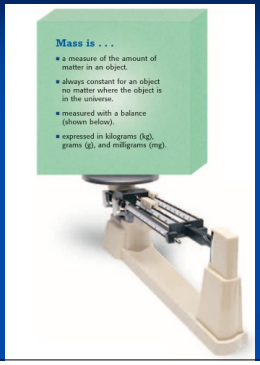
- Objects that take up space and have mass are called **matter.**
- Everything around you is made up of matter.
- Chocolate cake is made up of matter.
- You are made of matter.

- If you are having trouble understanding matter, look all around you.
- You can see matter makes up the walls of your house and your classroom.
- Matter is large and matter is small.

M is for Mass

- Mass is the **amount of matter** in an object.
- Mass is also affected by gravity.
- **Gravity** is a force of attraction between two objects.
- This force causes all objects to "pull" towards each other.
- The more mass two objects have; the stronger the pull.
- The closer the objects are to each other; the stronger the pull.

How are mass & weight different?



- **Mass -**
- **A measurement of the amount of matter in a object (grams). (The stuff that makes it up!)**

How are mass & weight different?

- **Weight -**
- **A measurement of the gravitational force of attraction of the earth acting on an object.**
- (When you get on a bathroom scale, this measures gravity pushing down on you)

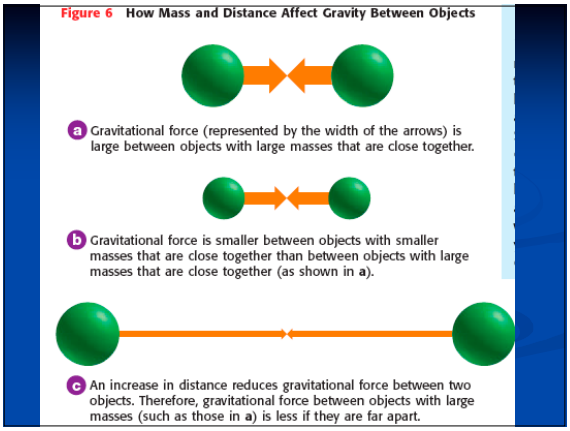
Weight vs Mass! Take notes on the back page

What about weight?

- Weight is the measure of **gravitational pull** on an object. Compare a brick to a sponge.
- The brick has mass. Earth has mass. Therefore, the brick and Earth are attracted to one another.
- The weight of the brick is a measure of this attraction by Earth.
- Now look at the sponge. It is the same ***size*** as the brick, but its ***mass*** is less.
- Therefore, the sponge's attraction to Earth is less. It's weight is also less than the brick.

Massive Confusion

- On Earth, gravity is the same everywhere.
- Sooo…. On Earth, mass and weight are the same thing.
- BUT, if you were to go to the moon, they would be different.
- The moon has less gravitational pull, so the attraction between you and the moon would be less.
- On the moon, your weight is less.
- Your mass remains the same though.



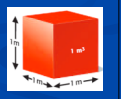
V is for Volume

- Briefly, volume is the **amount of space** something takes up.
- Whether it's a speck of dust or Jupiter, all matter takes up space.

Measuring the volume of…

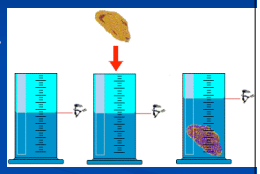
Liquids:
- Graduated cylinder
- Displacement method
- Measured in liters (L) & milliliters (mL)

Solids:
- Length x width x height

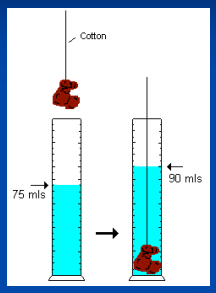


Gases:
- Since a gas expands to fill its container, if you know the volume of the container, you know the volume of the gas.

- **Density** - The mass of a substance divided by its volume
- Density is an important physical property. Density is the mass of a substance per unit volume.
- Volume is the amount of space an object occupies.



Extensive - Properties that do depend on the amount of matter present.



- **Volume** -
- A measurement of the amount of space a substance occupies.
- ***Length**

How can you describe something if you don't know what is it?

- Describing objects by using
- size
- shape
- color
- texture
- uses an object's **properties.**

Properties

- It doesn't matter what the object is, everyone can use similar descriptions.
- Size, Weight & Mass, Shape, Odor, Sound, etc.
- THESE are **physical properties**!
- **Remember all objects are made of matter, take up space and have mass.**

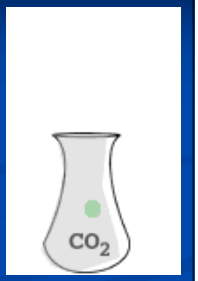
Common Physical properties

- Physical properties can be observed or measured **without** changing the identity of the matter.
- Density: the amount of matter in a substance **Density = mass/volume**
- Properties you notice when using one of your five senses:
  - Feel - mass, volume, texture
  - Sight - color Hear Smell Taste

Physical properties of matter are categorized as either: Intensive or Extensive:

- **Intensive** - Properties that do not depend on the amount of the matter present.
- Color & Odor
- **Luster:** How shiny a substance is.
- **Malleability** - The ability of a substance to be beaten into thin sheets.
- **Ductility** - The ability of a substance to be drawn into thin wires.

- **Conductivity** - The ability of a substance to allow the flow of energy or electricity.
- **Hardness** - How easily a substance can be scratched.
- **Melting/Freezing Point** The temperature at which the solid and liquid phases of a substance are in equilibrium at atmospheric pressure.
- **Boiling Point** - The temperature at which the vapor pressure of a liquid is equal to the pressure on the liquid (generally atmospheric pressure).



More Physical Properties

Physical property	Definition	Example
Thermal conductivity	The ability to transfer thermal energy from one area to another	Plastic foam is a poor conductor, so hot chocolate in a plastic-foam cup will not burn your hand.
State	The physical form in which a substance exists, such as a solid, liquid, or gas	Ice is water in its solid state.
Malleability (MAL ee uh BIL uh tee)	The ability to be pounded into thin sheets	Aluminum can be rolled or pounded into sheets to make foil.
Ductility (duhk TIL uh tee)	The ability to be drawn or pulled into a wire	Copper is often used to make wiring.
Solubility (SAHL yoo BIL uh tee)	The ability to dissolve in another substance	Sugar dissolves in water.
Density	Mass per unit volume	Lead is used to make sinkers for fishing line because lead is more dense than water.

Physical Changes:

- Changes in matter that do not alter the identity of the matter itself. Changes that **do NOT change** the identity of the substance.

More Examples of Physical Changes

- Freezing water for ice cubes
- Sanding a piece of wood
- Cutting your hair
- Crushing an aluminum can
- Bending a paper clip
- Mixing oil and vinegar

Physical Changes:
You may or may not be able to undo a physical change.

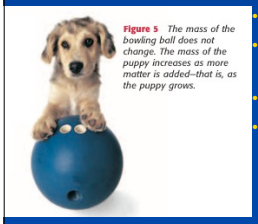


Figure 5 *The mass of the bowling ball does not change. The mass of the puppy increases as more matter is added–that is, as the puppy grows.*

- For example:
- 1. Size 2. Shape
- 3. State
- - solid liquid gas
- 4. Dilutions
- The water doesn't turn into soil or macaroni.
- It remains water.
- If it did change into soil or macaroni, your drink would taste terrible and you would have an example of a chemical change

- Please remember, ice is water in the solid state. When you drop the ice cube into the liquid, it begins to melt because the temperature is higher than that of the ice cube.
- It's like putting a snowman on your front lawn in July. The ice cube becomes liquid water.
- This is an example of a physical change.
- The solid water turned to liquid water.
- It is STILL water!

- **Common Errors**
- *Ice melting, water freezing, water evaporating, and steam condensing are all examples of a state change.
- *These are physical changes, not chemical.
- *Diluting a solution is a physical change, even if the color becomes more faint.

Melting is a physical change.

Physical properties-

- The measurement of mass and other characteristics that can be seen without changing how that object looks are its physical properties.
- When you look at oranges, you know that they are oranges because of their color, shape, and smell.
- **Mass, color, shape, volume, and density are some physical properties.**
- The answers to the question about the present are physical properties.

A property describes how an object looks, feels, or acts.

Properties are constantly changing...

Matter is constantly changing.

Ice in your soda melts, glass breaks, paper is ripped.

When ice in your soda melts where does it go? What does it become?

Physical vs. Chemical Properties

- **Physical properties:** observed without changing the identity of the substance
- **Chemical properties:** observe only when the identity changes
- How do you know if it is chemical or physical?
  - If it **CH**anges, it's **CH**emical

Chemical properties

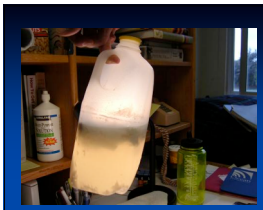
- A common chemical property is **reactivity.**
  - Reactive to oxygen
  - Reactive to air
  - Reactive to water…
- Chemical properties aren't always EASY to observe, unlike physical properties.

Chemical properties-

- These are properties that can only be observed by changing the identity of the substance.
- A piece of paper burns and turns to a black substance.
- After the flame goes out you can no longer burn the new substance.
- The chemical properties have been changed.

Chemical Changes

- Chemical changes *do* alter the identity of a substance
- In other words, a chemical change is when something changes into an **entirely different substance**
- For example:
  - Iron rusting
  - Wood burning
  - Copper turning to brass
  - Baking a cake
  - spoiled milk



- Milk needs to be in the refrigerator or else it will go bad.
- If you've ever seen or smelled spoiled milk, it is not a pretty sight.
- The milk gets a sour odor and becomes lumpy.
- Unlike physical changes, you cannot reverse chemical changes.
- You can melt ice to get water and freeze that water to get ice again.
- You cannot make milk unspoiled.

Examples of Chemical Changes

Comparing Physical and Chemical Properties

Substance	Physical property	Chemical property
Helium	less dense than air	nonflammable
Wood	grainy texture	flammable
Baking soda	white powder	reacts with vinegar to produce bubbles
Powdered sugar	white powder	does not react with vinegar
Rubbing alcohol	clear liquid	flammable
Red food coloring	red color	reacts with bleach and loses color
Iron	malleable	reacts with oxygen
Tin	malleable	reacts with oxygen

Brainpop

- Property changes!

- Brain Pop Property Changes Answers:
- 1. B
- 2. C
- 3. B
- 4. B
- 5. A
- 6. B
- 7. B
- 8. A
- 9. C
- 10. B

The Take Home Message

- State changes, like melting, freezing, boiling, are all **PHYSICAL** changes.
- The substance remains the same substance, it just changes what STATE it is in.