

Matter Study Guide

Sections 15-1, 15-2, 15-3, 16-1, 16-4 and 17-1

Matter: Anything that has mass and takes up space....

Or...the stuff that makes up anything that is made of something

Mass: The amount of matter in an object

Or...the AMOUNT of stuff that something is made of

Volume: The amount of space an object takes up

Or...the amount of space that stuff (matter) takes up

Density: Calculated by dividing mass volume. For a given substance at a given temperature, density is ALWAYS the same, regardless of how much there is.

Characteristic Properties: The things about an object that help us identify it

Examples: Boiling point, freezing point, density, solubility

TYPES OF MATTER

ELEMENTS	COMPOUNDS
<ul style="list-style-type: none">• Pure substances• Made up of ONLY one type of atom• May be many ISOTOPES (different # of neutrons) but still same element• Has definite characteristic properties• Often found as molecules (like O₂)• If atoms of an element are broken apart, new elements are formed	<ul style="list-style-type: none">• Pure substances• Made up of 2 or more types of elements chemically combined• Cannot be broken down without a chemical reaction• Has definite characteristic properties• Loses its properties if broken down• Glucose (C₆H₁₂O₆ and H₂O)
MIXTURES	
<ul style="list-style-type: none">• Two or more types of matter in the same place but NOT chemically combined• May be separated by mechanical means (filtering, sorting)• Parts keep their characteristic properties <p>May be heterogenous or homogenous (solutions)</p>	
SOLUTIONS	
<ul style="list-style-type: none">• Homogenous mixtures (the same thru and thru)• Solute – the substance that is dissolved• Solvent – the substance that does the dissolving• Solubility is a property• A saturated solution cannot dissolve any more solute	

PARTICLES of MATTER

- ATOM** – from the Greek word “atomos” (indivisible or uncuttable)
- the smallest particle of any element
 - made of protons (+), neutrons (no charge), and electrons (-)
 - electrons have very little mass
 - protons and neutrons make up the **NUCLEUS** of an atom
 - the nucleus is most of the mass of an atom
 - all atoms of an element have the same # of protons
 - atoms of different elements have different numbers of protons
 - atoms combine to form **COMPOUNDS**
 - atoms have a neutral charge (same number of protons and electrons)

Particle Accelerators give us the best evidence of what atoms are like and what they are made of, even helping us to understand that protons and neutrons are made of smaller particle called quarks.

- MOLECULE** – the smallest particle of any compound
- all compounds have a specific recipe, indicated by its chemical symbol
- H_2O has 2 hydrogens for each oxygen, CO_2 , $C_6H_{12}O_6$

The Periodic Table of the Elements tells us much about the structure of an element

- The atomic number tells us the number of **PROTONS** (positive charge) and therefore the number of **ELECTRONS** (negative charge)
- the number of protons in an atom determines what type of element it is
- Atomic Mass (or weight) is equal to the average number of protons + the number of neutrons

The nucleus is made of **PROTONS** and **NEUTRONS** (neutral, no charge). Electrons are found around the outside of the nucleus. The nucleus is most of the mass of an atom.

Solids, Liquids, and Gases

- The three **MAIN** states of matter

Solids – atoms are tightly packed together and are moving slowly. Solids have a small amount of energy in them. Solids have fixed shape and volume

Liquids – atoms are less tightly packed together, move faster, and contain more energy. Liquids have a fixed volume, but take the shape of the container they are in.

Gases – Atoms are very energetic, spread apart, and are moving very fast. Gases are not easily contained and do not have a definite shape or volume.

Scientists also recognize plasma as a phase of matter with a higher energy level than gases.

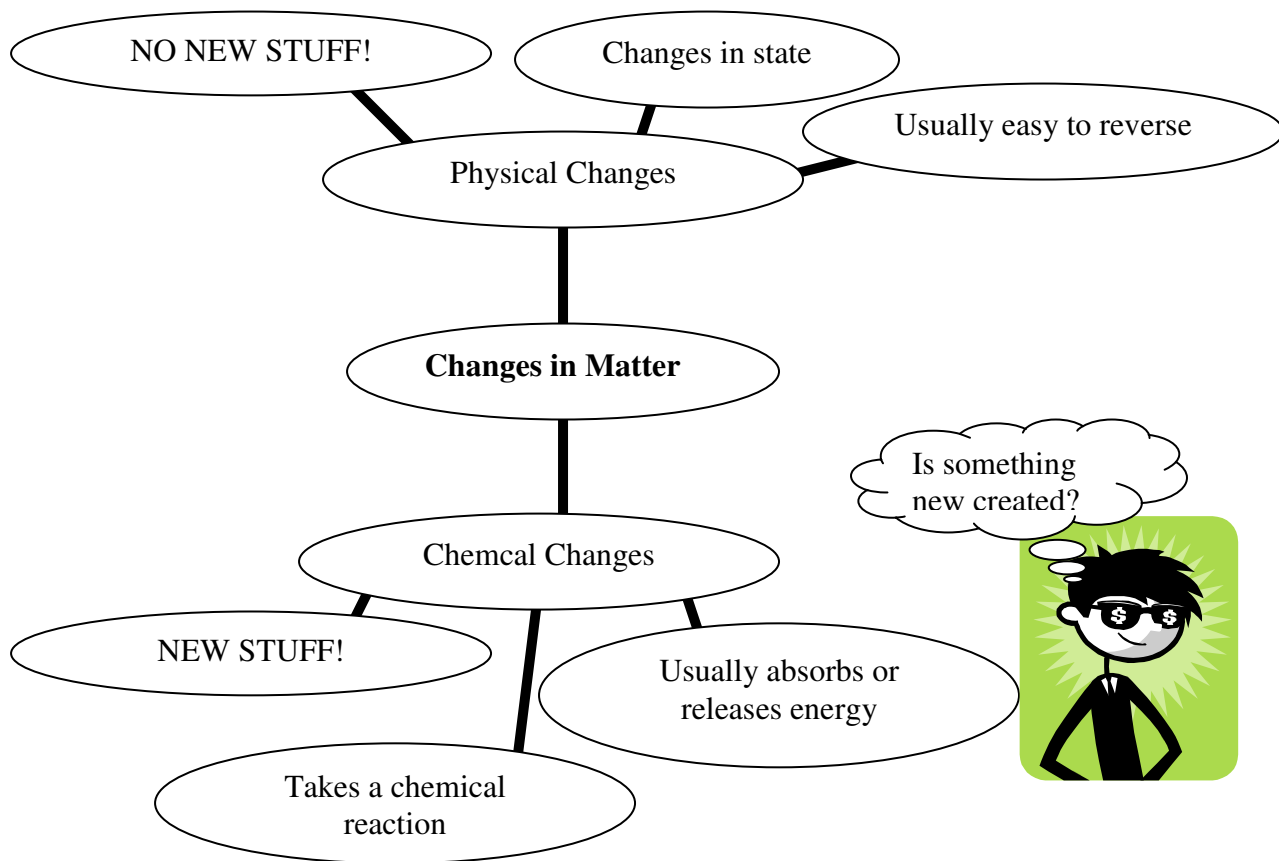
Changes in state

Adding heat to a solid will change it from a solid to a liquid (melting) to a gas (evaporation)

Removing heat from a gas (cooling it down) will cause it to change from a gas to a liquid (condensation) to a solid (freezing)

Some solids, like dry ice, can go from solid to gas phase directly by the process of sublimation.

Snow and frost form by the process of deposition when water vapor turns changes to ice crystals without becoming a liquid.



People who studied atoms:

Democritus – Gave us the term “atomos” to describe smallest pieces of matter

Dalton – First atomic theory

- Atoms can't be broken apart
- Atoms of an element are exactly alike
- Atoms combine to make compound in specific “recipes”
- Each elements has a unique mass

Rutherford – Demonstrated that there is empty space within atoms

Bohr- The planetary model of the atom

