SOL 5.4 -- MATTER

SOL 5.4 - Matter is anything that has mass and takes up space; and occurs as a solid, liquid, or gas.
Key concepts:

a. properties of each phase of matter;
b. the effect of temperature on the phases of matter;
c. atoms and elements;
d. molecules and compounds;
e. mixtures including solutions

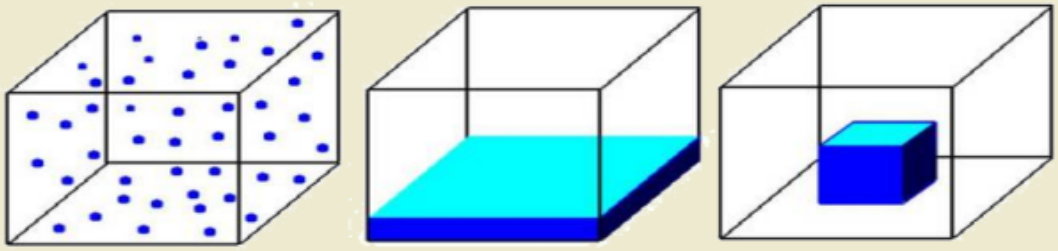
WHAT IS MATTER?

- Matter is anything that has mass and volume.
- Mass is the amount of matter in an object. The mass of an object does not change. (Weight of an object changes based on the gravitational pull on it. A person will have the same mass on Earth, Mars, and our moon. However, his or her weight on our moon will be 1/6 of what it is on Earth and will be 1/3 as much on Mars.)

PHASES OF MATTER : SOLID, LIQUID, GAS

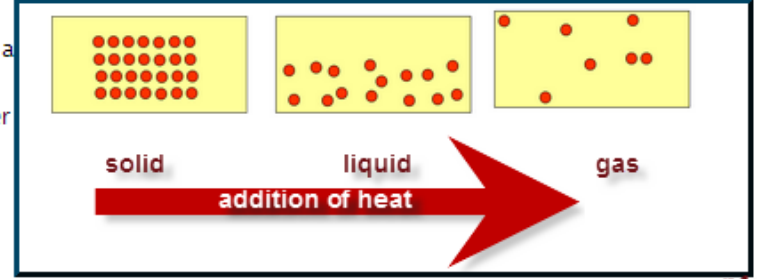
- Matter can exist in several distinct forms which are called phases. The three basic phases of matter generally found on Earth are gas, liquid, and solid. (Though other phases of matter have been identified, these are the phases of matter that fifth-grade students are expected to know.)

Characteristics of Gases, Liquids, and Solids



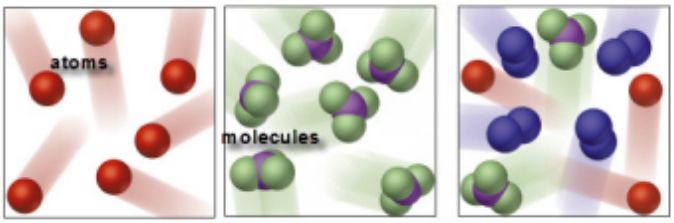
GAS	LIQUID	SOLID
Assumes the **shape of its container**	Assumes the **shape of its container**	Retains a **fixed shape**
Assumes the volume of its container – **no definite volume**	Has a **definite volume**	Has a **definite volume**
Compressible (lots of free space between particles)	**Not easily compressible** (little free space between particles)	**Not easily compressible** (little free space between particles)
Flows easily (particles can move past one another)	**Flows easily** (particles can move/slide past one another)	**Does not flow easily** (rigid-particles cannot move/slide past one another)

- As its temperature increases, many kinds of matter change from a solid to a liquid to a gas. As its temperature decreases, that matter changes from a gas to a liquid to a solid.



ATOMS, MOLECULES, ELEMENTS

- All matter, regardless of its size, shape, or color, is made of particles (**atoms** and **molecules**) that are too small to be seen by the unaided eye.
  - There are more than 100 known **elements** that make up all matter.
  - A few of the more familiar elements include: hydrogen (H), oxygen (O), helium (He), carbon (C), sodium (Na), and potassium (K).
  - The **smallest part** of an element is an **atom**.



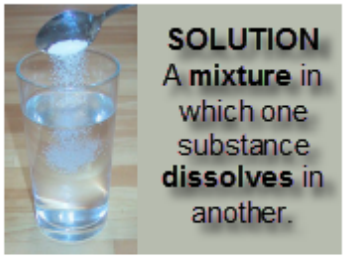
ELEMENT
examples:
oxygen (O)
hydrogen (H)
helium (He)
carbon (C)
potassium (K)
sodium (Na)

COMPOUND
examples:
table sale (NaCl)
water (H_2O)

MIXTURE
examples:
air
milk
salad dressing

MIXTURES & COMPOUNDS

- When two or more elements combine to form a **new substance**, it is called a **compound**.
  - There are many different types of compounds because atoms of elements combine in many different ways (and in different whole number ratios) to form different compounds.
  - Examples include **water** (H2O) and table **salt** (NaCl). The **smallest part** of a compound is a **molecule**.



- A **mixture** is a combination of two or more substances that do not lose their identifying characteristics when combined. A **solution** is a mixture in which one substance **dissolves** in another.

NANOTECHNOLOGY

- **Nanotechnology** is the study of materials at the **molecular (atomic) scale**. Items at this scale are so small they are no longer visible with the naked eye. Nanotechnology has shown that the behavior and properties of some substances at the nanoscale (a nanometer is one-billionth of a meter) contradict how they behave and what their properties are at the visible scale. Many products on the market today are already benefiting from nanotechnology such as sunscreens, scratch-resistant coatings, and medical procedures.