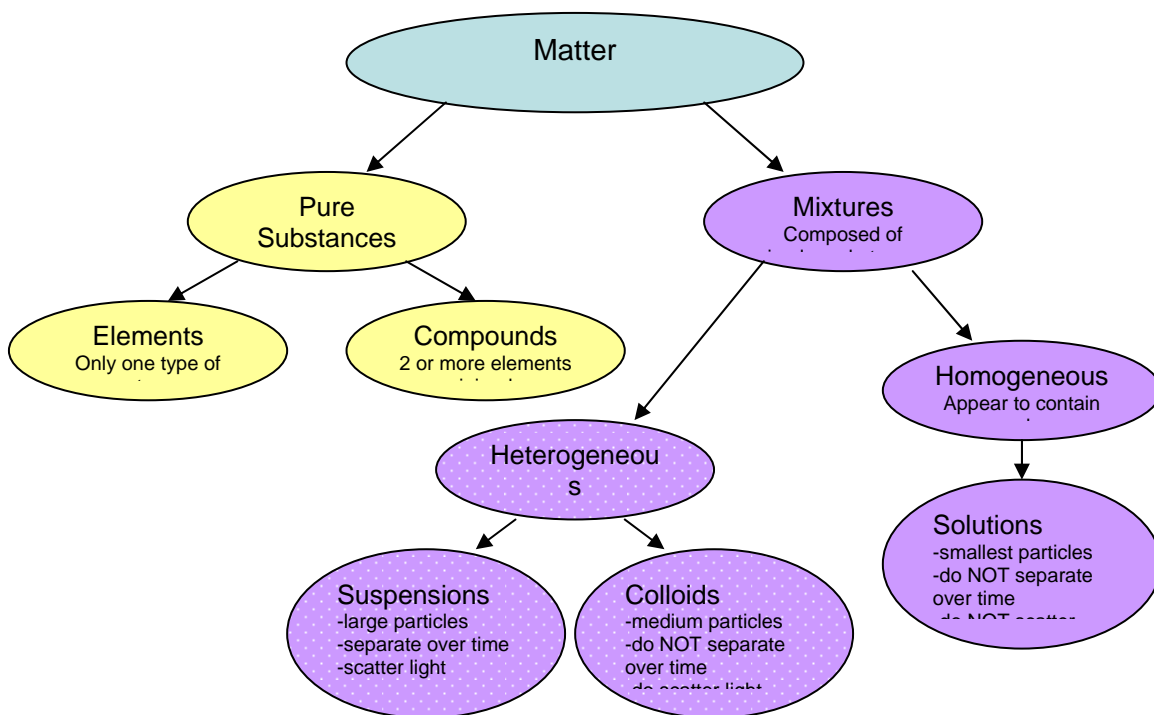


## Properties of Matter

- I. Classifying Matter
  - a. **Pure Substances**
    - i. *Matter that always has the exact same composition, and thus always has the same properties*
    - ii. Also known just as a **substance**
    - iii. Examples: table salt, sugar
    - iv. **Elements**
      1. *Substance that can't be broken down into simpler substances and contains only one type of atom*
      2. **Atom**: *smallest particle of an element*
      3. Examples: carbon, aluminum, gold, oxygen, nitrogen
      4. Most are solid at room temperature
      5. Symbols for elements: usually the first letter or two of the elements Latin name
    - v. **Compounds**
      1. *Substance made from two or more simpler substances; always contains two or more elements joined in a fixed proportion*
      2. Properties differ from those of component elements
      3. Example: water (made from hydrogen and oxygen)
  - b. **Mixtures**
    - i. *Matter composed of simpler substances, but not in a fixed proportion*
    - ii. Mixtures retain some properties of individual component substances
    - iii. Examples: salsa, curry
    - iv. **Heterogeneous mixture** (“hetero” (Greek) = different)
      1. Parts of mixture are noticeably different
      2. Examples: salad, sand
    - v. **Homogeneous mixture** (“homo” (Greek) = same)
      1. Parts of mixture are not noticeably different (even distribution)
      2. Appears to contain only one substance
      3. Examples: stainless steel, tea
  - c. **Solutions, Suspensions and Colloids**
    - i. Classifications of mixtures based on particle size
    - ii. **Solutions**: smallest particles (homogeneous), do not separate over time, filter out, nor scatter light; sugar water
    - iii. **Suspensions**: large particles (heterogeneous), separates into layers over time, scatters light; sand and water
    - iv. **Colloids**: medium particles (heterogeneous), do not separate nor filter out, do scatter light; fog, milk



## II. Physical Properties

- a. **Physical property:** *characteristic of a material that can be observed or measured without changing the composition of the substances in the material*
- b. **Viscosity**
  - i. *Resistance to flow*
  - ii. *Usually decreases with heat*
  - iii. *Example of application: motor oil*
- c. **Conductivity**
  - i. *Material's ability to allow heat to flow*
  - ii. *Example: copper*
- d. **Malleability**
  - i. *Ability of a solid to be hammered without shattering*
  - ii. *Metals are typically malleable; ice and glass are not (brittle)*
  - iii. *Affected by temperature (example: Terminator 2)*
- e. **Hardness**
  - i. *Comparative – can one material scratch another?*
  - ii. *Diamond is hardest natural material*
- f. **Melting point**
  - i. *Temperature at which a solid becomes a liquid*
  - ii. *Water: 0°C (32°F)*
  - iii. *Same temperature as freezing point (liquid turns to solid)*
- g. **Boiling point**
  - i. *Temperature at which a liquid becomes a gas*
  - ii. *Water: 100°C (212°F)*

- h. **Density**
  - i. *Ratio of a substance's mass to its volume*
  - ii. Constant for a pure substance
- i. **Physical changes**
  - i. Occur when some properties of a material change, but the substances in the material stay the same
  - ii. Examples: solid to liquid; size; shape
- III. **Chemical Properties**
  - a. **Chemical property:** *any ability to produce a change in the composition of matter; can only be observed when the substances in a sample of matter are changing into different substances*
  - b. **Flammability:** *ability to burn in oxygen*
  - c. **Reactivity:** *how easily a substance combines with other substances*
  - d. **Chemical changes:** occur when a substance reacts and forms one or more new substances
    - i. Color change
    - ii. Production of gas
    - iii. Formation of precipitate (solid that forms and separates from a liquid mixture)