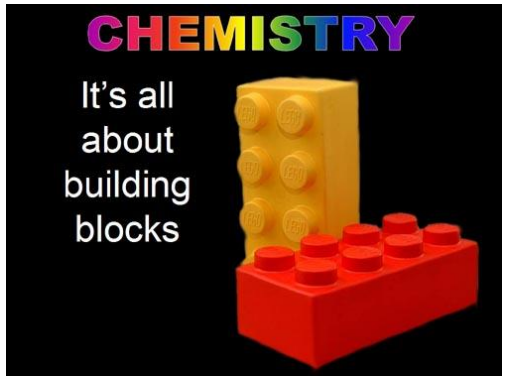
Introduction to Chemistry: Matter and Separation Techniques

Chapter 1

AP Chemistry

Classification of Matter

- **Matter-** anything that occupies space (has mass and volume)
- **Substance-** Has a fixed/definite composition and distinct properties (H_2O)
- **Element-** pure substance made of only one type of atom and can not be separated into simpler substances by chemical means
- **Compound-** substance made of 2 or more elements that are chemically bonded
  - Ionic
  - Covalent (molecular) ↔ Molecules
  - Metallic



Mixtures

- **Mixture -** combination of two or more substances in which the substances retain their distinct identities
  - **Homogenous Mixture-** composition is uniform throughout
  - **Heterogeneous Mixture-** composition is not uniform
- **Solution-** homogeneous mixture of two or more substances

Visual

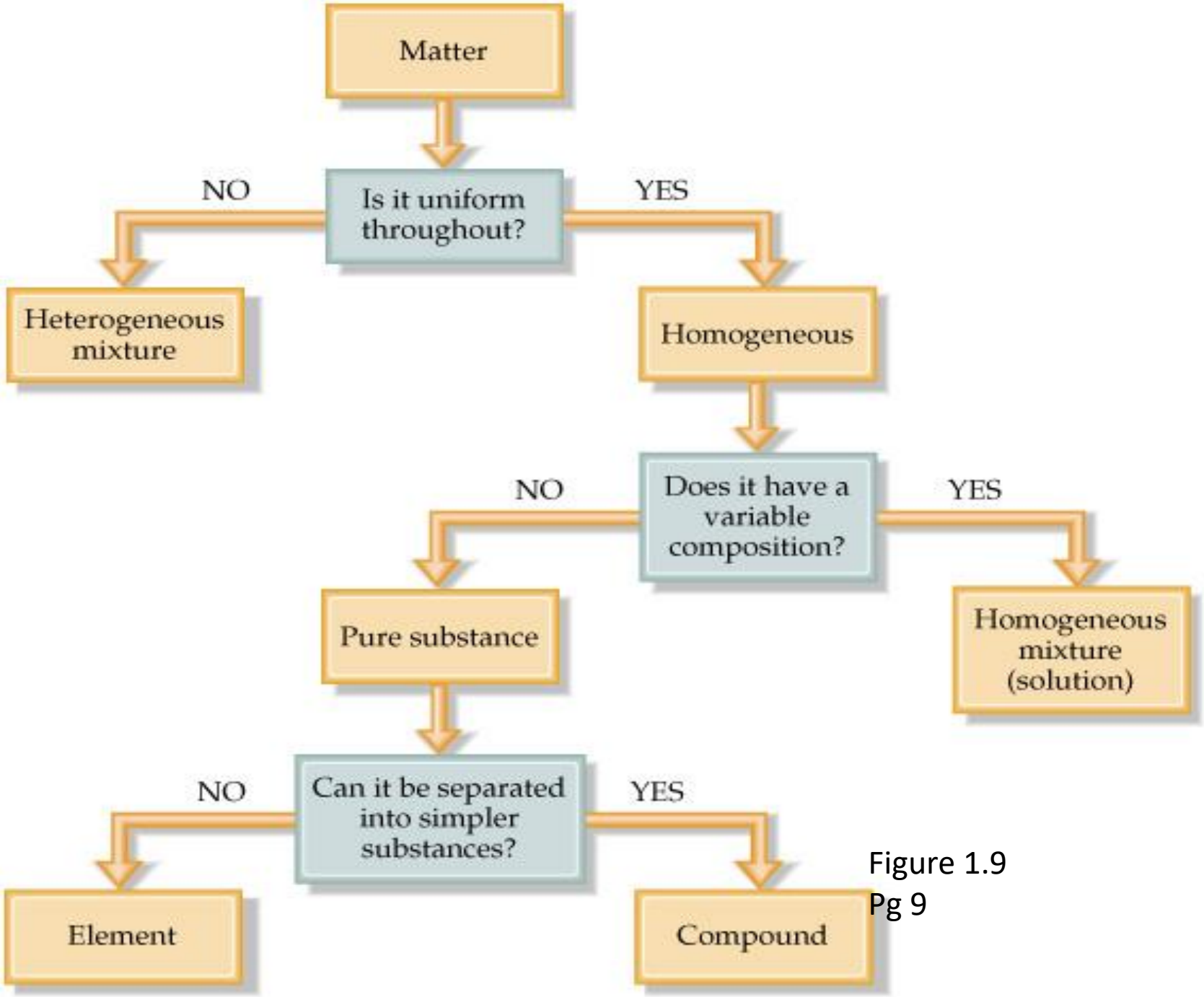


Figure 1.9
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States of Matter

- **Solid** – definite shape and volume
- **Liquid** – indefinite shape and definite volume
- **Gas** – indefinite shape and indefinite volume

States of Matter

- **Melting Point** – temperature at which a solid transitions to a liquid state

- **Boiling Point** – temperature at which a liquid transitions to a gas

Properties of Matter

- **Physical Property-** Can be observed without changing the identity of the composition

- **Chemical Property-** Describes a way a substance may change, or react, to form other substances

Intensive vs. Extensive Properties

- **Intensive property** – does not change with varying amounts

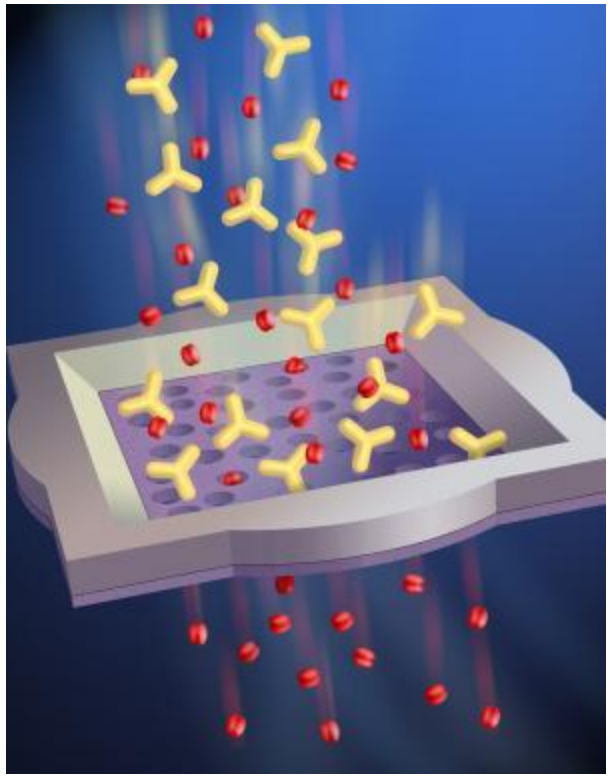
- **Extensive property** – depends on the amount

Separation Methods

- Can use properties of different substances to help separate/purify each component of a mixture
  - Filtration
  - Distillation
  - Centrifugation
  - Evaporation
  - Chromatography

Filtration

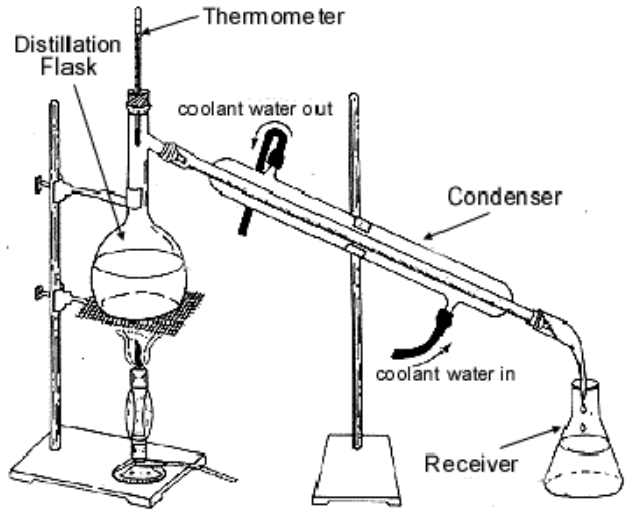
- Used to separate a solid from a liquid



Distillation

- Utilizes the physical property of boiling point to separate a liquid from a solid

Fractional Distillation can be used to separate liquids from each other



Centrifugation

- Used to separate liquids from solids or other liquids
- Utilizes centrifugal forces
- Denser materials move to bottom of tube while less dense materials sit on top
- Pellet and supernatant

Evaporation

- Essentially like distillation but easier
- Used when you want to collect a solid and the liquid can be discarded

Chromatography

- Separation is based on substances' attraction for the solvent and the matrix
- Matrix (stationary phase)
  - Cellulose and silica gel are common matrix materials
- Solvent (mobile phase)
  - Solvent may be polar or non-polar
  - Solvent may be liquid or gas

Chromatography Rf (Retention Factor)

- Ratio of distance substance moved to distance the solvent moved

- Helps identify unknown substances when compared to a control

$$Rf = \frac{\text{migration distance of substance}}{\text{migration distance of solvent front}}$$