Ch 3

States of Matter

- Describe the matter inside your container.

  What is the shape?

  Does it take up all the space in the container?

  Can you squeeze it and reduce the volume?

States of Matter

- Solids –

Definite shape

Definite volume

Solids can be soft like wax or hard like rocks

Examples: wood, iron, paper, sugar

States of Matter

- Liquids –

Takes shape of container

Definite volume

Liquids flow and the particles are not rigidly held in place

Examples: water, oil, mercury

States of Matter

- Gases –

Takes shape of its container

Takes volume of its container

Gas particles are far apart and are easily compressed

Examples: oxygen, carbon dioxide, helium

Vapor is a gaseous state of something that is a solid or liquid at room temperature

Physical Properties of Matter

Extrinsic (extensive)

If I cut my object in half,
this property would **change**

Mass
Volume
Length

Intrinsic (intensive)

If I cut my object in half,
this property would be **the same**

Color
Density
Taste
Smell

These are all categorized as PHYSICAL properties

Chemical Properties of Matter

Ability to CHANGE and REACT with other matter

Rusting

Burning

Reactivity with Acids or Bases

Chemical or Physical Properties??

- $Fe + O_2 \rightarrow Fe_2O_3$ (RUST!)
- Iron is more dense than Aluminum.
- Magnesium burns brightly when ignited.
- Sugar dissolves in water.
- Sugar burning.
- Mercury is a liquid at room temperature.
- Chlorine has a green colored flame.
- Liquid water cannot reach temperatures high than 373 K.

Conservation of Mass

- Matter is neither chemically created nor destroyed

Whatever mass you start with, you end up with!

Mass of Reactants = Mass of Products

Bread + Cheese → Grilled Cheese Sandwich

1 g + 0.5g 1.5g

Practice Problems

- In the complete reaction of 22.99g of sodium with 35.45 g of chlorine, what mass of sodium chloride is formed?

- A 12.2 g sample of X reacts with a sample of Y to form 78.9 g of XY. What is the mass of Y that reacted?

Warm Up!

- If you combust 30 g of propane gas (C_3H_8) and collect 24.46 g of carbon dioxide and 14.32 g of water, how much oxygen reacted (see unbalanced equation below)?

$$C_3H_6 + O_2 \rightarrow CO_2 + H_2O$$

- Is combustion a chemical or physical property?
- What are the properties of a substance?
- Is C_3H_6 (propane) a substance?

Today's Agenda

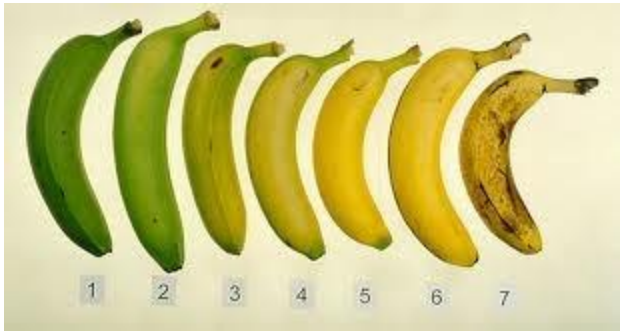
- Question of the Day: What is molar mass and how is it used to find mass percents?

- Review from Friday
- Percent by mass calculations using atomic/molar mass
- Create a Matter chart!

- HW: pg 95 #32-40 evens, 41, 42 -50 evens,54-62 evens

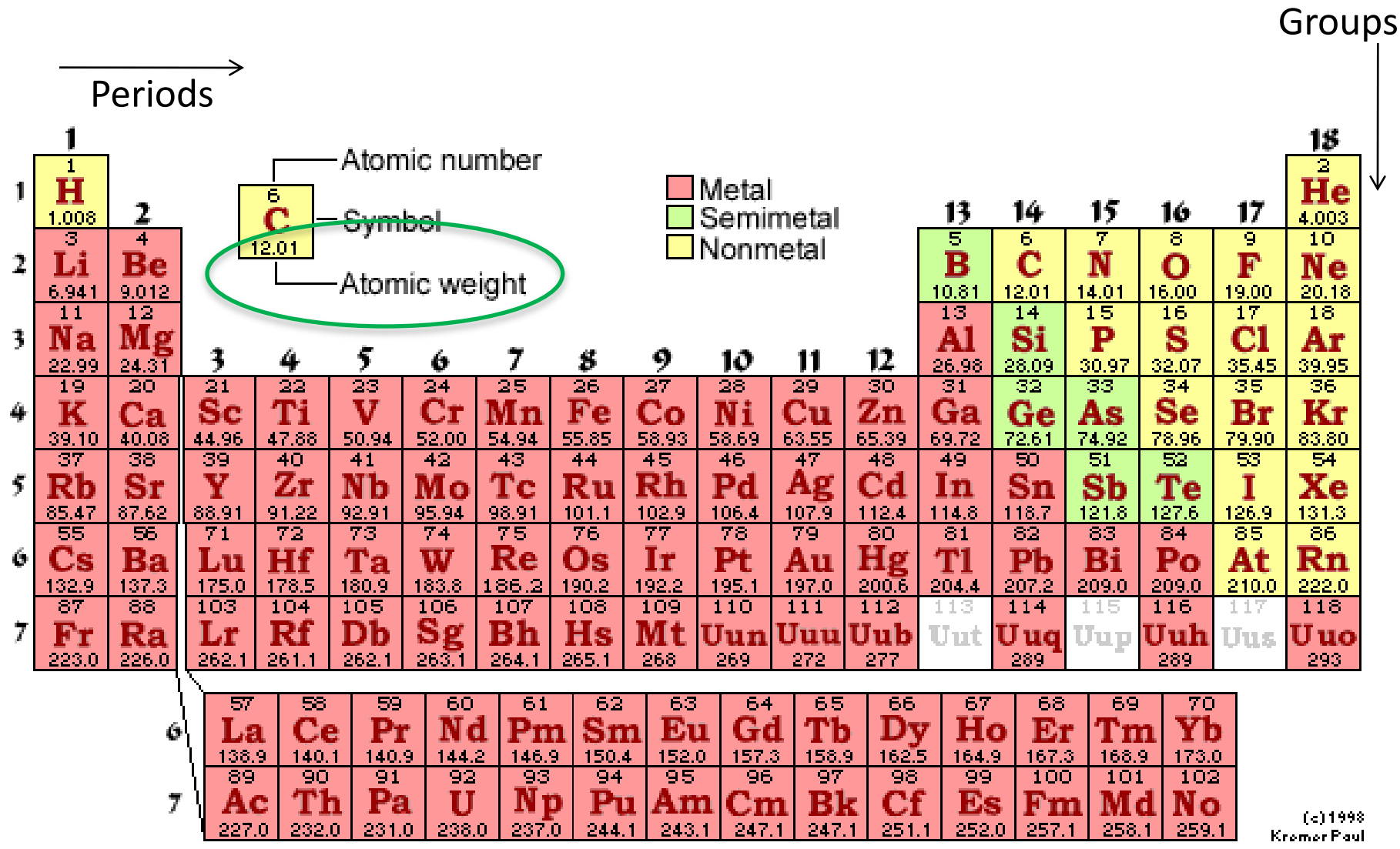
Review from Yesterday

- Physical or Chemical change??
  - Rusting
  - Freezing water
  - Crushing an aluminum can
  - Fruit ripening



- If 3g of iron reacts with 4 g of oxygen how many grams of rust is produced?
  - Can you write out the chemical equation??
- Name 1 instrinsic and 1 extrinsic property

Periodic Table



Percent By Mass Calculations

What's in that compound???

$$\text{Percent by mass (\%)} = \left[\frac{\text{mass of element}}{\text{mass of compound}}\right] \times 100$$

Percent by Mass

What is the percentage of oxygen in water??

H_2O

1. Find mass of each element on Periodic table

$Mass_H = 1$ g/mol

$Mass_O = 16$ g/mol

Percent by Mass

2. Find mass of total compound by adding up grams of each element in compound.

$Mass_H = 1$ g/mol

$Mass_O = 16$ g/mol

Mass of $H_2O = (2 \times 1) + (1 \times 16) = 18$ g/mol

There's 2 Hydrogens!

$Mass_H$

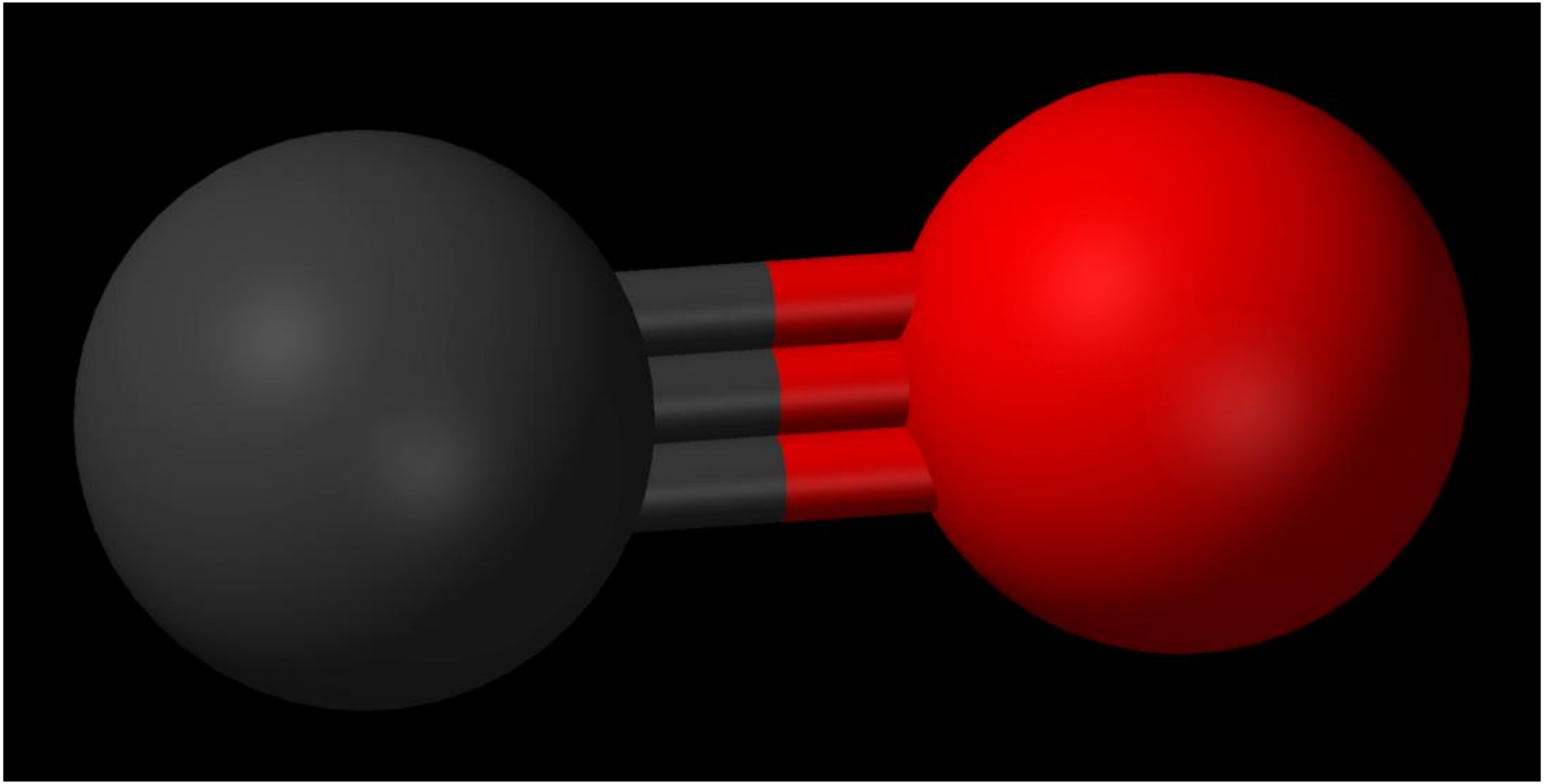
$Mass_O$

Percent Mass

3. Take the mass of molecule of interest (Oxygen in our case) and divide by the TOTAL mass found in step 2

$$\% \text{ Oxygen} = \left[\frac{16 \text{ g/mol}}{18 \text{ g/mol}} \right] \times 100 = 88.9\%$$

Whats the % mass of Oxygen in CO?



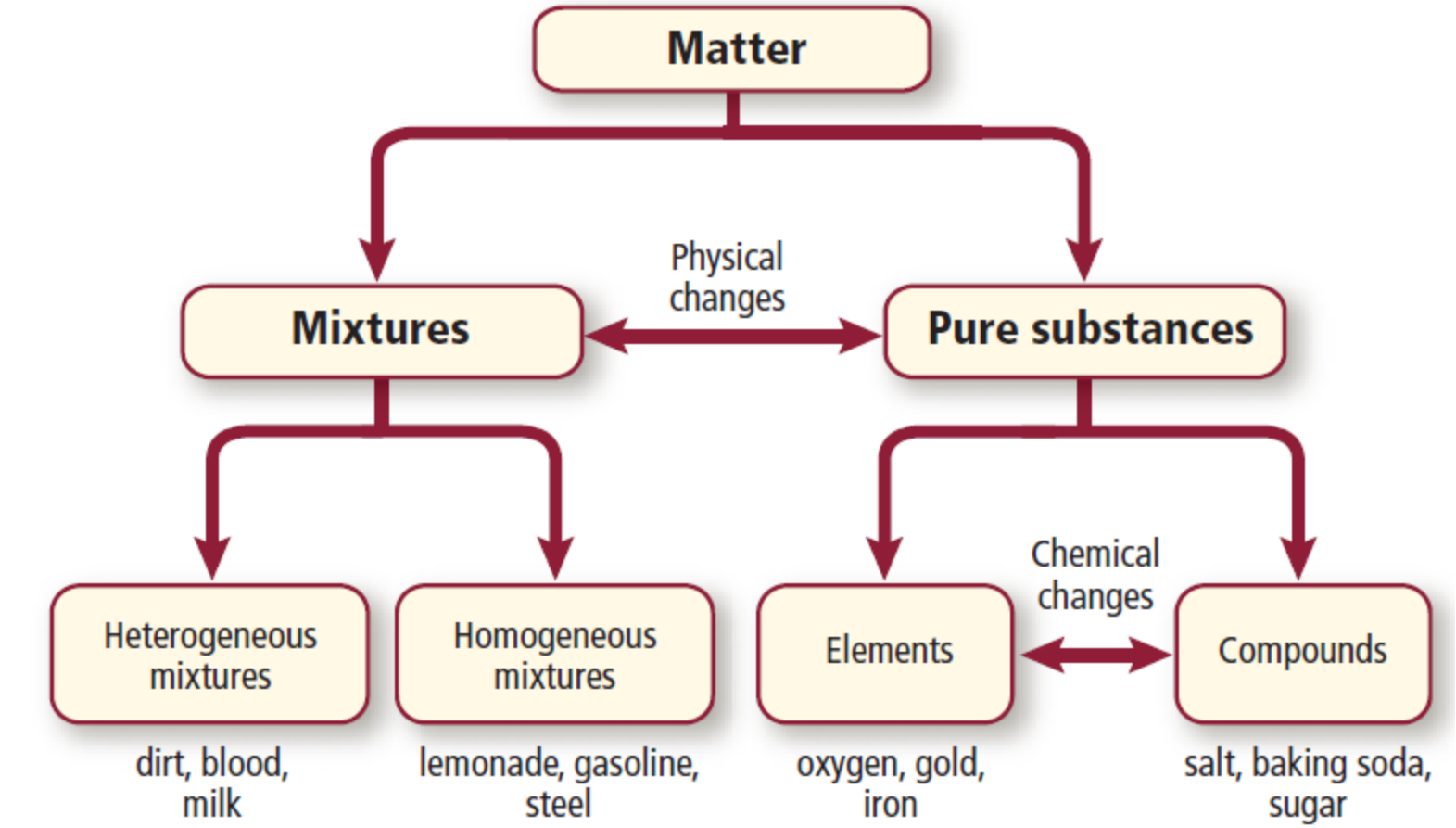
Practice Problems

- A 78 g sample of an unknown compound contains 12.4 g of hydrogen. What is the percent by mass of hydrogen?
- 1.0 g of hydrogen reacts completely with 19.0 g of fluorine. What is the percent by mass of hydrogen in the compound that is formed?
- Calculate the percent by weight of each element present in sodium sulfate (Na_2SO_4).
- Calculate the percent by mass of phosphorus and chlorine in phosphorus trichloride (PCl_3)

Complex Chemical Formulas

- $Ca_3(PO_4)_2$
  - How many atoms of Ca? P? O?
  - Find formula mass
  - Find percent P by mass in $Ca_3(PO_4)_2$
- $Al_2(CO_3)_3$
  - How many atoms of Al? C? O?
  - Find the formula mass
  - Find percent Al by mass in $Al_2(CO_3)_3$

Substances and Pure Mixtures

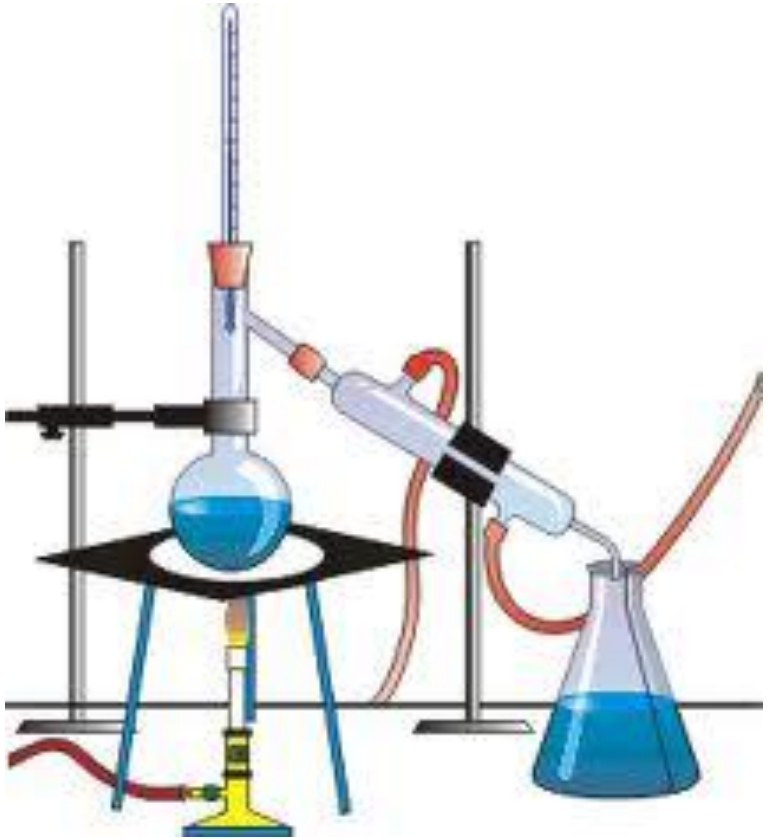


Separating Mixtures

- Filtration – separates solids from liquids

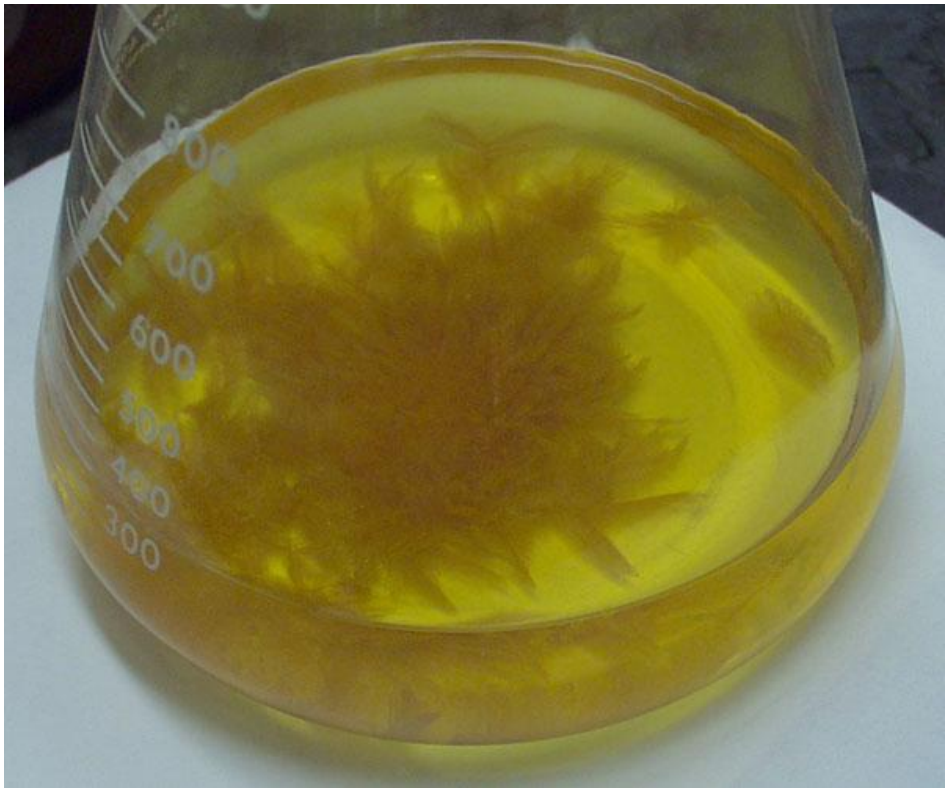
Separating Mixtures

- Distillation – separates liquids by boiling point



Separating Mixtures

- Crystallization – removes pure solids from solutions by saturating the solution and forcing the solid to crystallize.



Separating Mixtures

- Sublimation – separates two solids by transitioning from the solid to vapor without melting. The vapor then undergoes deposition to form pure crystals.

Separating Mixtures

- Chromatography – separates liquids or gases by using a mobile phase and a stationary phase. Separation occurs as one component sticks to the stationary phase while the other does not.