

## Separating Solutions

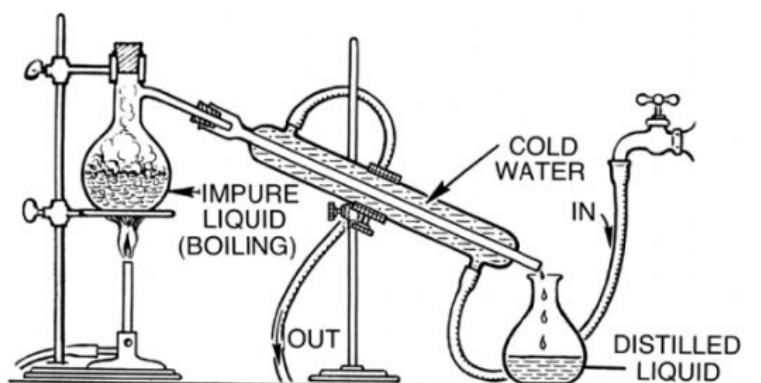
- when a solute is dissolved in a solvent, the particles of the two mix together but the particles themselves aren't changed
  - e.g. sugar dissolves in water but the sugar particles remain unchanged (the water still tastes sweet)
- we can separate solutions in two ways

### 1) Evaporation

- **evaporation** is the change of matter from liquid to gas
  - works well when separating a liquid and a solid
- the solution is heated until the liquid component turns to a gas, leaving behind the solid component that had been dissolved in the solution
  - e.g. to separate the sugar-water solution mentioned earlier, we can heat the solution to  $100^{\circ}\text{C}$ 
    - this will cause the water to change state from liquid to gas and therefore separate from the solution
    - once the water evaporates, the sugar will be left behind in the pot

### 2) Distillation

- **distillation** is the process of separating liquids in a solution by heating the solution, trapping and cooling the gas and collecting the resulting pure liquid
  - works well when separating solutions made of two liquids, as long as the liquid have different boiling points
- the solution is heated to a point at which one of the component liquids will boil off and the other will remain as a liquid
  - the steam that boils off of the solution (made of the first component) is collected and cooled, causing it to condense back into a liquid
  - the result is two separate containers, each containing a pure form of the two components



- e.g. a solution of water (boiling point of  $100^{\circ}\text{C}$ ) and ethanol (boiling point of  $78^{\circ}\text{C}$ ) can be separated by distillation
  - the water-ethanol solution is heated to just over  $78^{\circ}\text{C}$ , causing the ethanol to boil but allowing the water to remain as a liquid
  - the ethanol steam is captured and made to flow through a cooling chamber
  - the ethanol steam is condensed back into a liquid and this liquid is collected
  - the result is pure water in the first container and pure ethanol in the second container

**ASSIGNMENT:**

1. How would you separate each of the following mixtures?
  - a. a salt and water solution?
  - b. a solution of rubbing alcohol (boiling point of  $82^{\circ}\text{C}$ ) and water (boiling point  $100^{\circ}\text{C}$ )
2. How is the idea of separating solutions by evaporation used when making maple syrup from sap?