

# Unit 3- Lesson 7

Chemistry 0

April 2021, L. Tracey Gao



# Separation of Mixtures

- The most appropriate technique for separating a mixture depends on the type of mixture and the physical properties of the components.
- Physical properties include color, size, melting point, boiling point, volatility, and solubility.

# Sand and Pebbles



A Mixture of Sand and Pebbles can be separated according to size.

## Physical Properties

|         | Color | Size  | Melting Point | Boiling Point | Volatility | Solubility |
|---------|-------|-------|---------------|---------------|------------|------------|
| Sand    | -     | Small | -             | -             | -          | -          |
| Pebbles | -     | Large | -             | -             | -          | -          |

# Sand and Table Salt



A Mixture of Sand and Table Salt can be separated according to solubility.

## Physical Properties

|         | Color | Size | Melting Point | Boiling Point | Volatility | Solubility |
|---------|-------|------|---------------|---------------|------------|------------|
| Sand    | -     | -    | -             | -             | -          | Insoluble  |
| Pebbles | -     | -    | -             | -             | -          | Soluble    |

# Alcohol and Water



A Mixture of Alcohol and Water can be separated according to solubility.

## Physical Properties

|         | Color | Size | Melting Point | Boiling Point | Volatility         | Solubility |
|---------|-------|------|---------------|---------------|--------------------|------------|
| Alcohol | -     | -    | -             | 80 °C         | Higher than water  | -          |
| Water   | -     | -    | -             | 100 °C        | Lower than alcohol | -          |



# Techniques of Separation

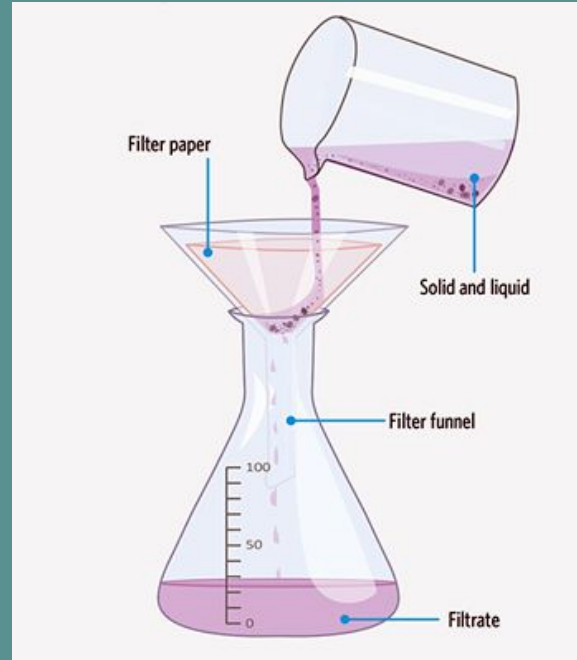
- Separation techniques depend on the differences in physical properties for each component in a mixture, including color, size, melting point, boiling point, volatility and solubility.
  - Filtration
  - Evaporation
  - Distillation
  - Chromatography



# Filtration

- **Filtration** separates components of a mixture based on the differences in their physical sizes, usually a mixture containing *an undissolved solid* in a *liquid*.
- To separate a mixture by filtration, a **filter** is used.
- The holes in a filter are called **pores**.
- The pore size will vary depending on the relative sizes of the components of the mixture.
- The pore size of a filter is selected so that only part of the mixture go through the pores with the remaining mixture retained by the filter.

# Filtration



[https://qknowbooks.gitbooks.io/class\\_5\\_science-mixtures/content/filtration.html](https://qknowbooks.gitbooks.io/class_5_science-mixtures/content/filtration.html)

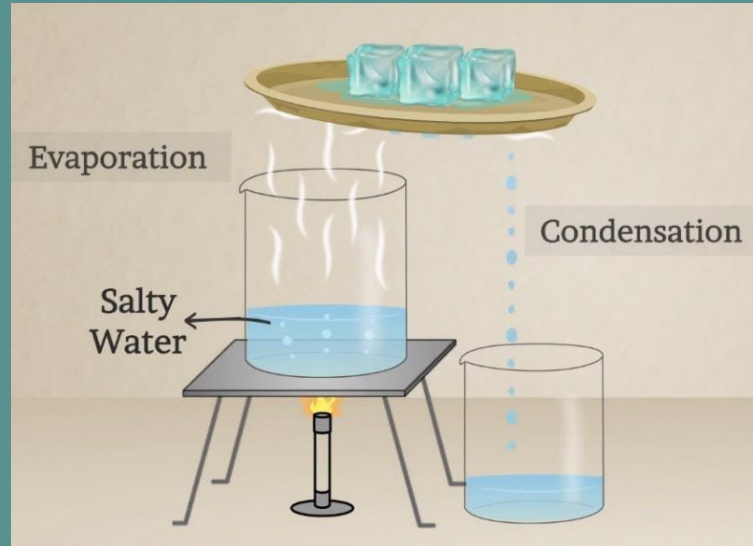




# Evaporation

- **Evaporation** separates components of a mixture based on the differences in volatility.
- Molecules that are volatile have a lower boiling point than molecules that are not volatile.
- It can be used as a separation method to separate components of a mixture with *a dissolved solid* in a *liquid*. The liquid is evaporated, meaning it is convert from its liquid state to gaseous state. This often requires heat. Once the liquid is completely evaporated, the solid is all that is left behind.

# Evaporation



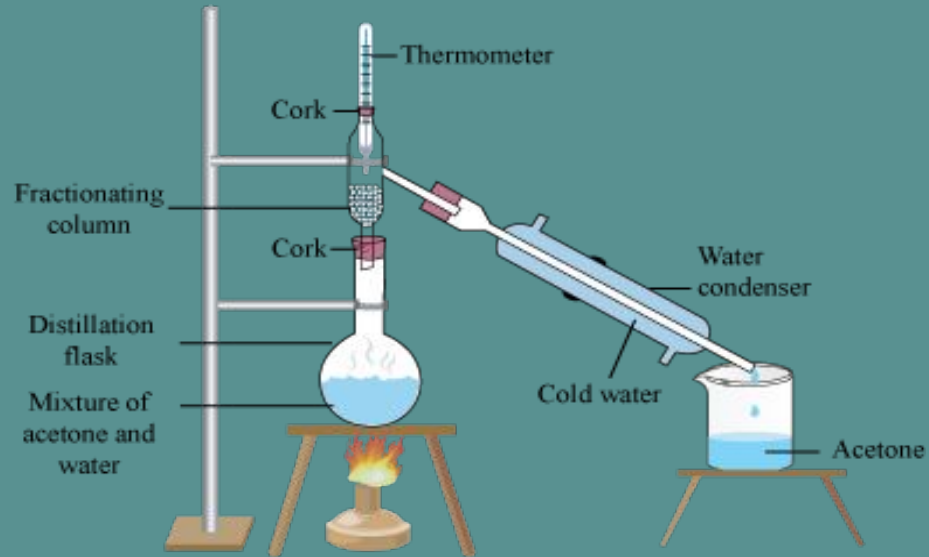
<https://www.youtube.com/watch?v=hp8H54gMK6Q>



# Distillation

- **Distillation** also separates components of a mixture based on the differences in volatility. It is performed using a **distillation apparatus**.
- It is a separation technique used to separate components of *a liquid mixture* by a process of heating and cooling.
- A distillation apparatus is able to capture the more volatile component and cools it back to a liquid, thus separating it from the other components in the mixture.

# Distillation



<https://www.quora.com/What-is-the-separation-of-two-miscible-liquids-by-distillation-and-what-is-this-method-called>

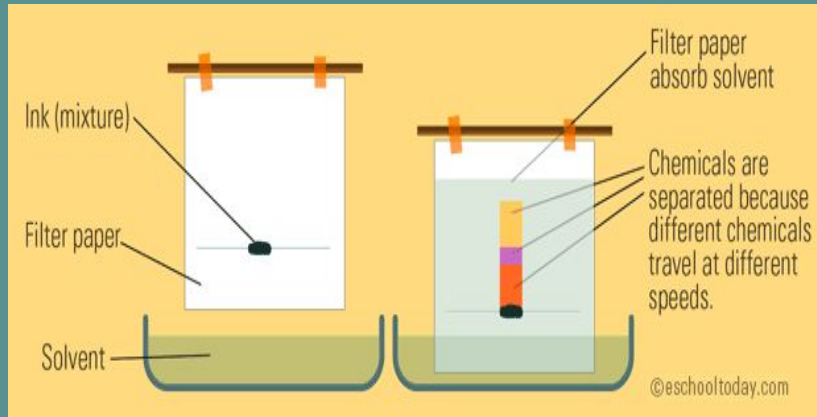


# Chromatography

- **Chromatography** separates components of a mixture using differences in mobility- the difference in how fast each component moves through a given medium.
- Mixtures are separated by chromatography by first dissolving them in a solvent (called **mobile phase**) and then passing the dissolved mixture through a finely powdered solid (called **stationary phase**).
- As the mixture in the mobile phase passes over the stationary phase, the components in the mixture will migrate faster or slower through the stationary phase.

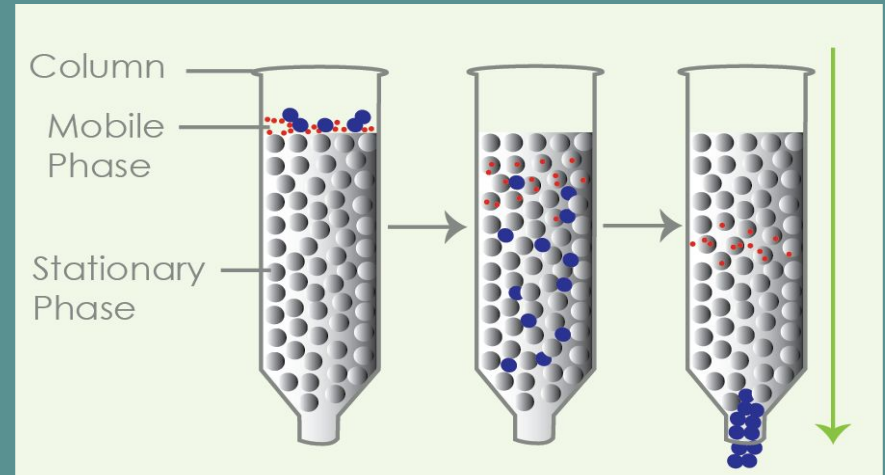
# Liquid Chromatography

## Paper Chromatography



<http://www.eschooltoday.com>

## Column Chromatography



<https://www.goldbio.com/articles/article/how-column-chromatography-works-to-separate-proteins>



## Summary

- Separation techniques depend on the differences in physical properties for each component in a mixture.
- Filtration separates components of a mixture based on the differences in their physical size.
- Evaporation and distillation separate components of a mixture based on their differences in volatility.
- Chromatography separates components of a mixture based on their differences in mobility through a solid.