

# Separating Mixtures

## List

- explain the principle behind separation of mixtures
- describe some common methods of separating mixtures and give examples of each

## Notes

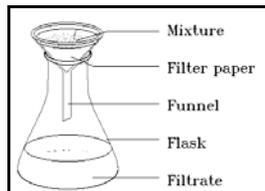
### Mixtures are separated by physical means

- ☆ Since the components of mixtures retain their properties, the differences among the properties of the substances in a mixture can be used to separate them
- ☆ no chemical change occurs to the substances during separation
- ☆ the original substances remain after the separation

### Methods of Separation and Purification of Mixtures

#### ★ Filtration

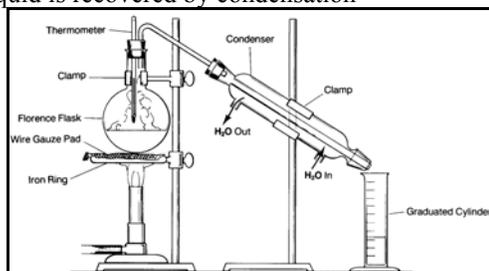
- ☆ Purpose - used to separate suspended particles from mixtures
- ☆ Definition - separation of large particles from a mixture as they pass through a porous substance such as a filter or screen
- ☆ Examples



- ☆ swimming pool - water is pumped through a filter that removes dirt and debris
- ☆ filter cigarettes - filter reduces the amount of material inhaled through the burning cigarette [NOTE: There is no evidence that the harmful effects of smoking are reduced by filters.]

#### ★ Distillation

- ☆ Purpose - used to separate solid-liquid mixtures and liquid-liquid mixtures
- ☆ Definition - separation of mixtures based on the different boiling points of the components of the mixture
- ☆ Procedure
  - ☆ a liquid is removed from a mixture by evaporation
    - ☆ the liquid with the lower boiling point evaporates first
  - ☆ the liquid is recovered by condensation



#### ☆ Examples

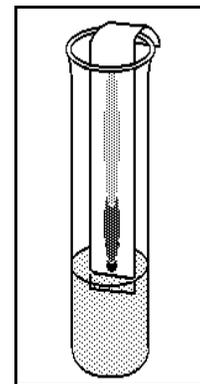
- ☆ condensation of steam on the bathroom mirror after showering
- ☆ fractional distillation of petroleum - crude oil is separated into fractions such as: natural gas; gasoline; kerosene; lubricating oil; fuel oil
- ☆ separation of alcohol and water to make liquors

#### ★ Simple crystallization

- ☆ Purpose - to purify a solid
- ☆ Definition - a process in which crystals are formed
- ☆ Procedure
  - ☆ a solid is dissolved in a liquid
  - ☆ the liquid is evaporated
- ☆ Example - collection of salt from the ocean
  - ☆ seawater flows into shallow ponds
  - ☆ suspended particles settle (sedimentation)
  - ☆ saltwater flows into shallow pans where the water is evaporated by the sun (solar evaporation)

#### ★ Chromatography

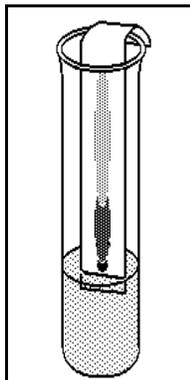
- ☆ Purpose - to separate dyes and other soluble materials
- ☆ Definition - separation technique based on the different attractions of two or more substances to a stationary and a mobile phase
- ☆ Procedure (paper chromatography)
  - ☆ put a spot of dye near one end of a strip of paper
  - ☆ suspend the strip of paper in a solvent with the spot of dye above the level of the solvent
    - ☆ the solvent is absorbed by the paper
    - ☆ the solvent passes through the dye
    - ☆ different substances in the dye travel at different rates as the solvent moves up the paper
    - ☆ the dye separates
  - ☆ calculate the R<sub>f</sub> values
    - ☆ measure the distance the spot travels
    - ☆ measure the distance the solvent travels
    - ☆ divide the distance the spot travels by the distance the solvent travels
    - ☆ use the R<sub>f</sub> value to identify the spot



Answer the questions below by circling the number of the correct response

1. The separation technique shown in the diagram at the right is

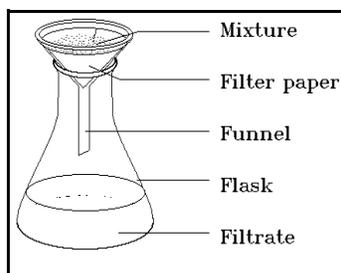
- (1) filtration
- (2) distillation
- (3) chromatography
- (4) recrystallization



2. The separation of substances in a mixture depends on the fact that the substances in the mixture (1) have different properties, (2) are chemically combined, (3) have large particles, (4) show the Tyndall effect.

3. A mixture of sand and salt is separated using the apparatus shown at the right by pouring water through the mixture. What material will be found in the filtrate after pouring water through the mixture?

- (1) sand and saltwater
- (2) water only
- (3) salt only
- (4) saltwater only



4. The liquid portion of a mixture is recovered during distillation by (1) solar evaporation, (2) recrystallization, (3) chromatography, (4) condensation.

5. The water in a swimming pool is kept free of debris by the process of (1) simple crystallization, (2) fractional distillation, (3) filtration, (4) chlorination

6. A filter is able to separate mixtures because it is (1) porous, (2) homogeneous, (3) heterogeneous, (4) impermeable.

7. The separation of mixtures based on the different boiling points of the components of the mixture is called (1) chromatography, (2) distillation, (3) filtration, (4) recrystallization.

8. Which method of separation is based on the fact that different substances travel along a stationary phase at different rates as a solvent moves through them? (1) simple crystallization (2) recrystallization (3) distillation (4) chromatography

For each of the following situations, write the correct number on the answer space to indicate if the best method of separation to use is (1) CHROMATOGRAPHY; (2) DISTILLATION; (3) FILTRATION; or (4) SIMPLE CRYSTALLIZATION

- 9. Separating starch and water
- 10. Separating chlorophyll and the other pigments in a leaf
- 11. Separating gasoline from other liquid hydrocarbons