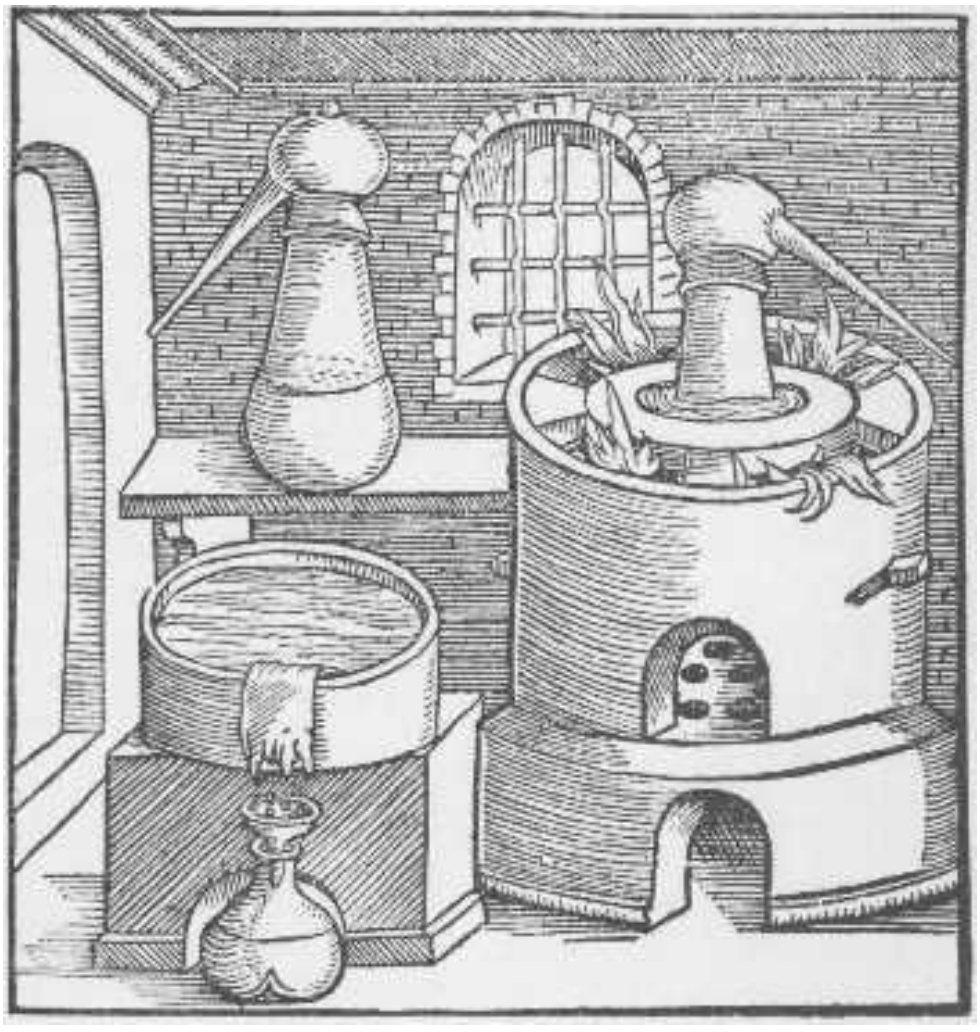
# ScE7.3.3 : Separating Mixtures and Solutions

## Outline and Study Guide

1. Introduction activity : Observing Mixtures
2. Separating heterogeneous mixtures : hand sorting, magnetism, flotation, filtration, evaporation.
3. Lab activity : filtration
4. Separating homogeneous mixtures : evaporation, distillation, paper chromatography.
   a) Demonstration : Evaporating a salt solution
   b) Lab activity : Evaporating different liquids
   c) Demonstation : Distillation
   d) Different distillation equipment.
   e) Lab activity : Paper chromatography



Terms

| | | |
|---|---|---|
| **paper chromatography** | **filtration** | **magnetism** |
| **flottation** | **hand sorting** | **evaporation** |
| **distillation** | | |

1. _____ : to separate a mixture by hand, one piece at a time.
2. _____: separation method using a magnet to pull out metal pieces from a mixture.
3. _____ : separation method using water to float some substances while others sink.
4. _____ : separation method using a filter that retains large particles while letting smaller ones through.
5. _____ : separation method where one substance evaporates into the air while others do not, and remain in the original container.
6. _____ : separation method where a liquid solution is heated to evaporate one component, then the vapor is collected and recondensed to recover the pure liquid.
7. _____ : a method for separating coloured substances from a mix, using paper and a solvent.

# Separating Heterogeneous Mixtures.

Listen to your teacher and complete the description of separation methods in the first column. Then observe the pictures of examples that are displayed around the classroom, and classify the examples for each separation method.

| Separation Method | Examples |
|---|---|
| | |

| | |
|---|---|
| | |
| | |
| | |
| | |

# Lab Activity : Filtration

**Purpose** : To compare the filtration of homogeneous and heterogeneous mixtures.

**Hypotheses** :

1. Do you think it is possible to separate sand and water (a heterogeneous mixture) by filtration ? _____

   Why, or why not ? _____

   _____

2. Do you think it is possible to separate drink crystals and water (a homogeneous mixture) by filtration ? _____

   Why, or why not ? _____

   _____

**Material (per group)** : an erlenemeyer, a funnel, two filter papers, a spoon, water, a little sand in one plastic cup, and drink crystals in another.

**Procedure** :

1. Add 2-3 cm water to the cups containing the sand and the drink crystals. Observe the mixtures and describe in the Observation Table.
2. Fold a filter paper to make a cone as shown by your teacher, and set in the funnel on top of the erlenmeyer.
3. Filter the sand + water mix. Observe the filtrate (the liquid that went through the filter) and the residue (left in the filter paper), and describe them in the Observation Table.
4. Discard the filter paper in the garbage. Pour out the filtrate in the sink and rinse out the erlenmeyer.
5. Repeat with the water + drink crystal mix.

**Observation Table** :

| | Water + Sand | Water + Drink Crystals |
|---|---|---|
| Homogeneous or heterogeneous | | |
| Description of mix before filtration | | |
| Description of filtrate | | |
| Description of residue | | |

## Conclusions :

1. Did filtration work to separate the heterogeneous mixture ? _____
2. Did filtration work to separate the homogeneous mixture ? _____
3. Explain the difference using particle theory.

_____

_____

_____

_____

_____

# Other Examples of Filtrates and Residues

| Filtration | Filtrate | Residue |
|---|---|---|
| Separating sand from pebbles by sifting with a screen | | |
| Straining spaghetti | | |
| Using a dust mask to protect yourself from breathing dust in the air | | |

# Activity : Evaporating Solutions

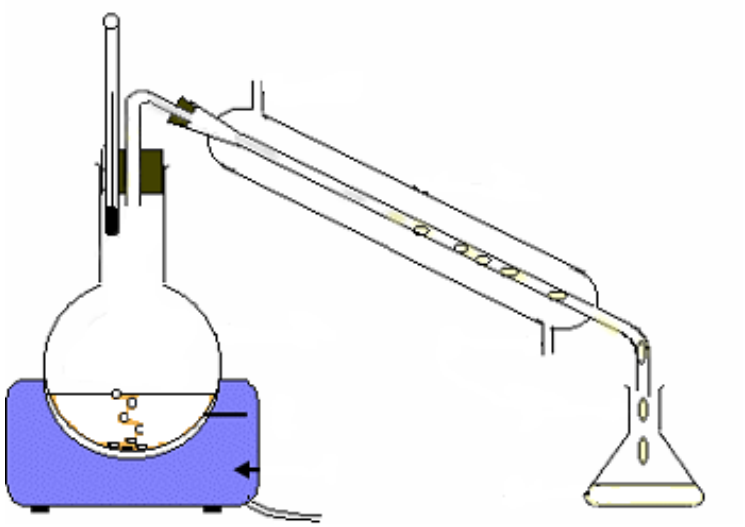
**Procedure** : Each group will get a different solution. Measure 20 mL of solution, pour into a petri dish, and let evaporate over several days until dry.

## Observations :

| Solution | Description of residue |
|---|---|
| | |
| | |
| | |
| | |

# Demonstration : Distillation

**Observe the demonstration of distillation prepared by your teacher. Use the diagram below to answer the questions.**



Colour code :

- ☐ The solution to be distilled
- ☐ The water vapor
- ☐ Where the water vapor condenses
- ☐ The pure distilled water
- ☐ The cold water running through the condenser.

## Questions :

1. Colour the different parts of the diagram according to the legend on the right. Choose your own colours for the colour code.

2. Label the three most important parts on the diagram :
   - The distilling flask
   - The condenser
   - The collector

3. At the end of the distillation, where are the water molecules?

4. At the end of the distillation, where are the solute molecules?

5. Why do you need cold water running through the condenser?

6. Observe the SmartBoard activity then write down the steps of the distillation in the correct order.

| Step | What happens |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |

1. Name two industries that use distillation.

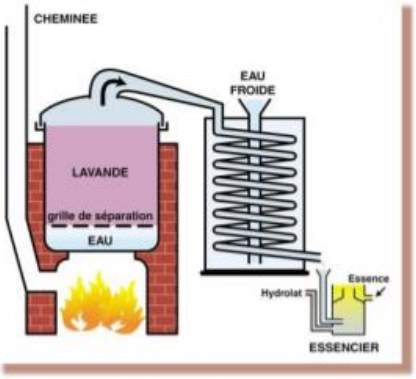
# Different Distillation Equipments

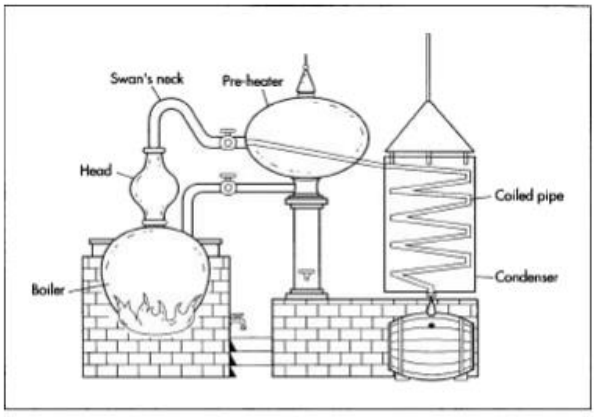
**Examine the pictures of different distillation equipments and try to figure out which part is the condenser, and how they work. Label each diagram with the three parts as indicated.**

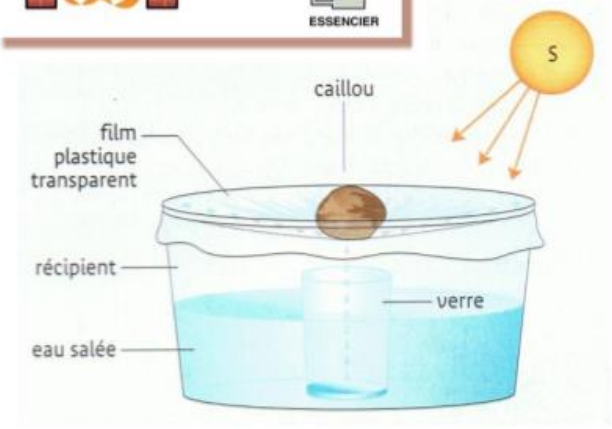
D = Distillation flask (where the solution starts)

Cond = condenser

Coll = collector (where the distilled liquid is at the end)



# Summary of Separation Methods

| Separation Method : **Hand Sorting** | |
|---|---|
| Sketch | Explain how it works |
| One example of a mix you might separate by this method | |
| Does this method separate homogeneous mixtures, homogeneous mixtures, or both? | |

| Separation Method : **Magnetism** | |
|---|---|
| Sketch | Explain how it works |
| One example of a mix you might separate by this method | |
| Does this method separate homogeneous mixtures, homogeneous mixtures, or both? | |

| Separation Method : **Flotation** | |
|---|---|
| Sketch | Explain how it works |
| One example of a mix you might separate by this method | |
| Does this method separate homogeneous mixtures, homogeneous mixtures, or both? | |

| Separation Method : **Filtration** | |
|---|---|
| Sketch | Explain how it works |
| One example of a mix you might separate by this method | |
| Does this method separate homogeneous mixtures, homogeneous mixtures, or both? | |

| Separation Method : **Evaporation** | |
|---|---|
| Sketch | Explain how it works |
| One example of a mix you might separate by this method | |
| Does this method separate homogeneous mixtures, homogeneous mixtures, or both? | |

| Separation Method : **Distillation** | |
|---|---|
| Sketch | Explain how it works |
| One example of a mix you might separate by this method | |
| Does this method separate homogeneous mixtures, homogeneous mixtures, or both? | |