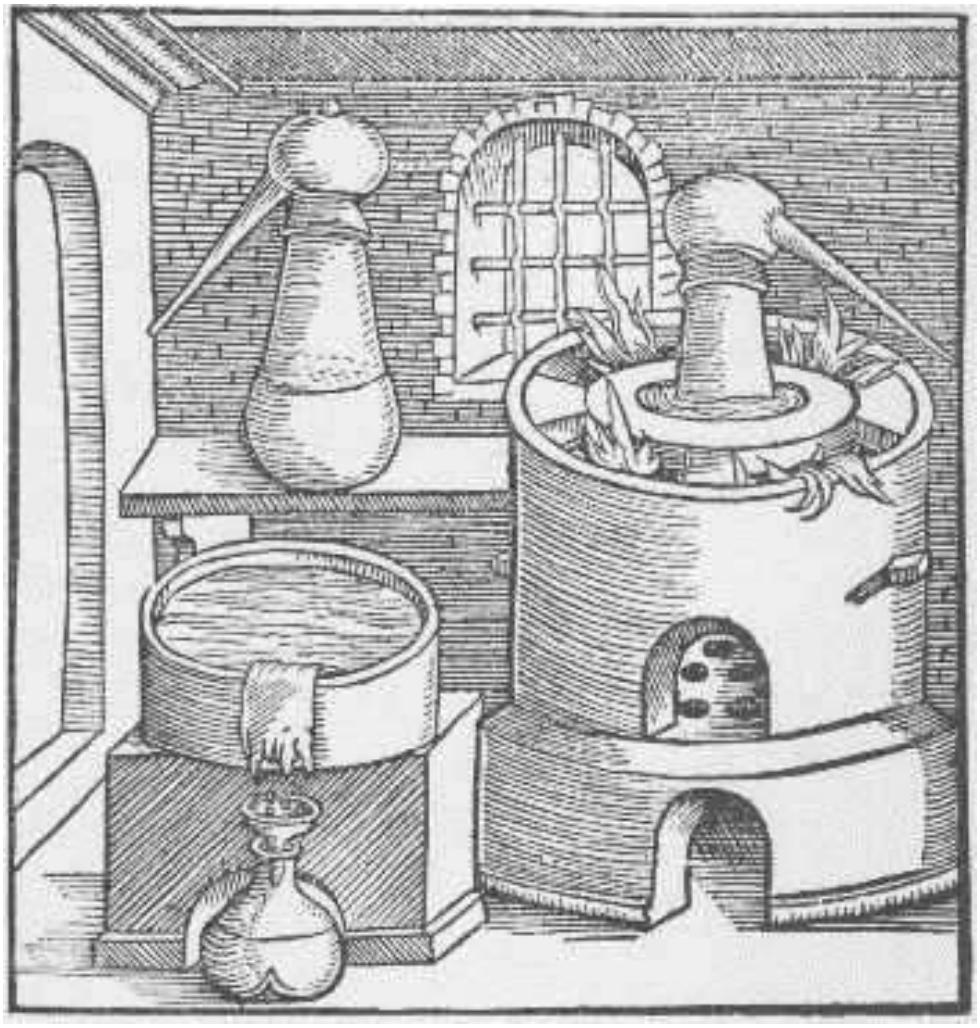
ScE7.3.3 : Separating Mixtures and Solutions - **ANSWERS**

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**
flotation	**hand sorting**	**evaporation**
distillation		

1. **Hand sorting** : to separate a mixture by hand, one piece at a time.
2. **magnetism** separation method using a magnet to pull out metal pieces from a mixture.
3. **flotation** : separation method using water to float some substances while others sink.
4. **filtration** : separation method using a filter that retains large particles while letting smaller ones through.
5. **Evaporation** : separation method where one substance evaporates into the air while others do not, and remain in the original container.
6. **Distillation** : 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. **Paper chromatography** : 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
Hand sorting: when you pick apart the different parts of a mixture using your hands or tools.	• **Tidying your room** • **Picking olives off a pizza**

Magnetism : when you separate pieces of metal from a mixture using a magnet.	• **Separating small nails from sand** • **Junkyards use giant electromagnets to separate metal car parts from other parts.**
Flotation : when you separate a mixture by making some substances float and others sink.	• **Separating fat from soup when it floats to the surface** • **Floating logs on a river, then taking them up from the water when they get to the paper mill.** • **Panning for gold separates the gold from the sand by making it sink to the bottom of the pan.**
Filtration: When you use a filter to separate a mixture based on the size of the particles. The smaller particles go through the filter (filtrate) and the bigger ones stay caught (residue)	• **Separating coffee from coffee grounds using a coffee filter** • **A dust mask filters the dust from the air.**
Evaporation : When you evaporate one substance from a mixture and other substances stay behind.	• **When salt water on your boots dries and salt is left behind.** • **When wet clothes dry on a clothesline.**

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	**Heterogeneous**	**Homogeneous**
Description of mix before filtration	**A cloudy colourless liquid with grey/beige grains in the bottom**	**Clear, orange liquid**
Description of filtrate	**A colourless liquid, clear or slightly cloudy.**	**Clear, orange liquid**
Description of residue	**Grey/beige grains**	**No residue**

Conclusions :

1. Did filtration work to separate the heterogeneous mixture ? Yes
2. Did filtration work to separate the homogeneous mixture ? No
3. Explain the difference using particle theory.

Filtration works to separate the water + sand mixture because the grains of sand are made up of many particles and are too big to go through the filter.

But when the drink crystals dissolve in the water the particle separate, and then they are so small that they can pass through the filter.

Other Examples of Filtrates and Residues

Filtration	Filtrate	Residue
Separating sand from pebbles by sifting with a screen	**Sand**	**Pebbles**
Straining spaghetti	**Water**	**Spaghetti**
Using a dust mask to protect yourself from breathing dust in the air	**Air**	**Dust**

Activity : Evaporating Solutions

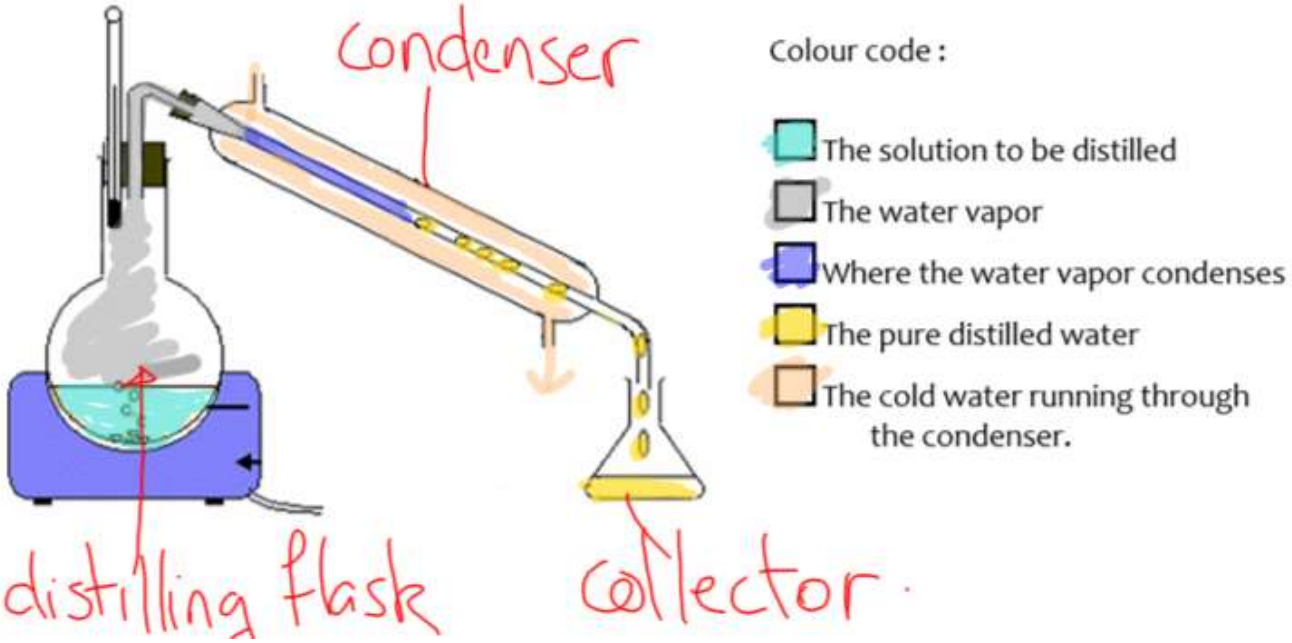
Procedure : Each group will get a different solution. Measure 20 mL of solution, pour into a petri dish, and let evaporate over several days until dry.

Observations :

Solution	Description of residue

Demonstration : Distillation

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



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? **In the collector**

4. At the end of the distillation, where are the solute molecules? **In the distilling flask**

5. Why do you need cold water running through the condenser? **To make the walls of the condensor cold enough that the water vapor will change back to a liquid.**

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

Step	What happens
1	**The solution in the distilling flask boils**
2	**The water evaporates**
3	**The steam goes up the column.**
4	**The steam goes into the condenser.**
5	**The steam condenses back to water.**
6	**The water drips down the condenser.**
7	**The pure water drops down into the collector.**

1. Name two industries that use distillation.

- **Oil & gas industry: to separate the different fuels from the crude oil.**
- **Alcohol: to separate stronger alcohol from fermented liquids.**

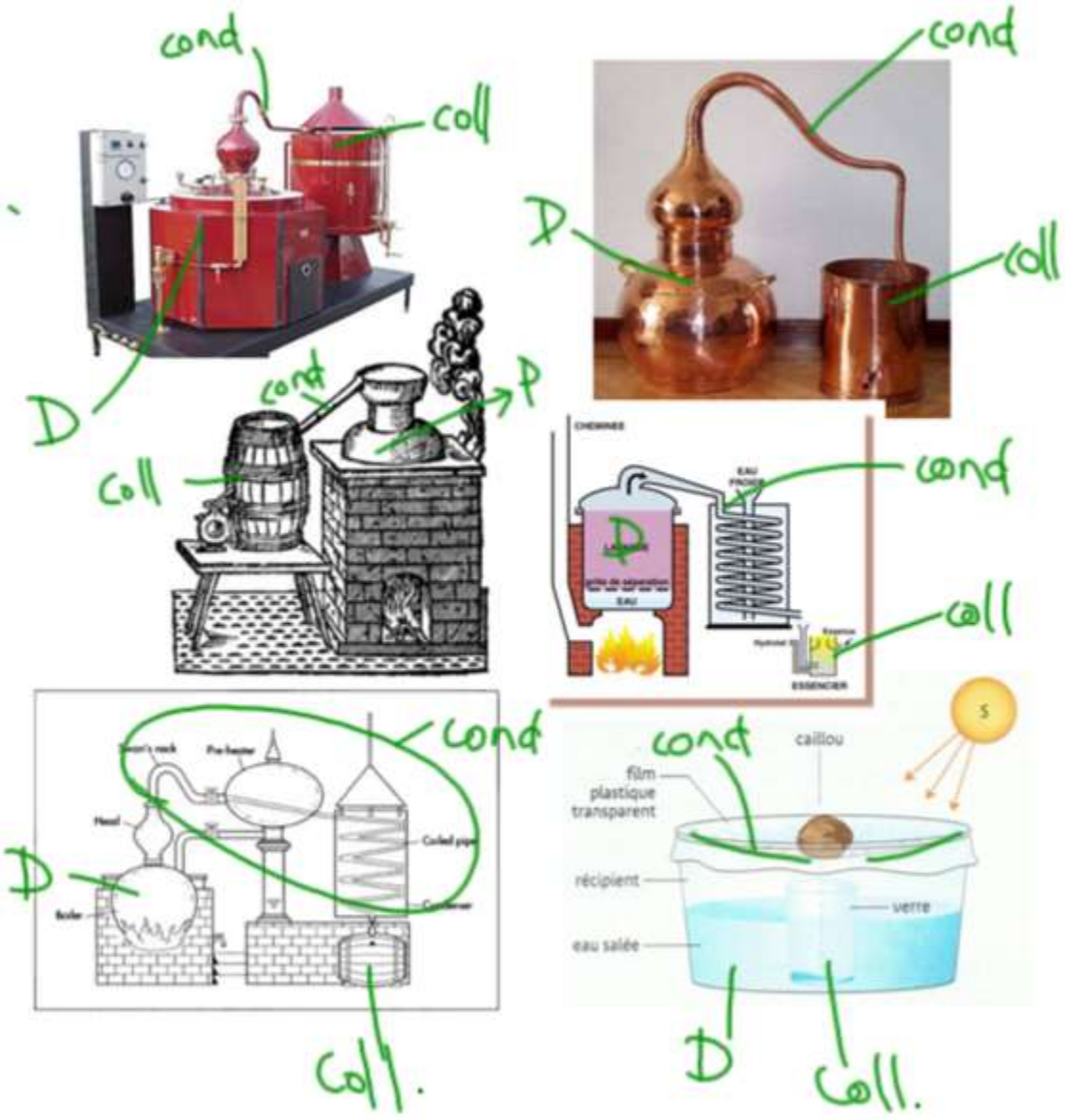
Different Distillation Equipments

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 **Hand sorting: when you pick apart the different parts of a mixture using your hands or tools.**
One example of a mix you might separate by this method **Picking olives off a pizza**	
Does this method separate homogeneous mixtures, homogeneous mixtures, or both? **Heterogeneous only**	

Separation Method : **Magnetism**	
Sketch	Explain how it works **when you separate pieces of metal from a mixture using a magnet.**
One example of a mix you might separate by this method **Separating small nails from sand**	
Does this method separate homogeneous mixtures, homogeneous mixtures, or both? **Heterogeneous only**	

Separation Method : **Flotation**	
Sketch	Explain how it works **when you separate a mixture by making some substances float and others sink.**
One example of a mix you might separate by this method **Separating fat from soup when it floats to the surface**	
Does this method separate homogeneous mixtures, homogeneous mixtures, or both? **Heterogeneous only**	

Separation Method : **Filtration**	
Sketch	Explain how it works **When you use a filter to separate a mixture based on the size of the particles. The smaller particles go through the filter (filtrate) and the bigger ones stay caught (residue)**
One example of a mix you might separate by this method **Separating coffee from coffee grounds using a coffee filter**	
Does this method separate homogeneous mixtures, homogeneous mixtures, or both? **Heterogeneous only**	

Separation Method : **Evaporation**	
Sketch	Explain how it works **When you evaporate one substance from a mixture and other substances stay behind.**
One example of a mix you might separate by this method **Drying clothes**	
Does this method separate homogeneous mixtures, homogeneous mixtures, or both? **Both**	

Separation Method : **Distillation**	
Sketch	Explain how it works **One substance is evaporated from a mixture, then recondensed into a liquid and recovered.**
One example of a mix you might separate by this method **Separating drinkable water from seawater.**	
Does this method separate homogeneous mixtures, homogeneous mixtures, or both? **Both**	