Types of Mixtures and their Separation

Grade IX
Estimated number of students: 24
Duration: 90 minutes

1. **Objectives**

- Explaining colloidal solutions, suspensions, and true solutions with illustrations.
- Illustrating the transparency of colloids and solutions.
- Showing the separation of mixtures using different methods.

2. Learning Outcomes

After the completion of this module, the students will be able to do the following:

- understand that the components of a mixture are separated based on their physical and chemical properties.
- recall the different types of colloids.
- observe the optical properties of colloid and true solution.
- explain the role of colloids in cosmetics, foods, and pharmaceuticals.

3. **Prerequisite knowledge**

Before commencing with this module, the students must have a prior knowledge of the following:

- Differences between pure substances and mixtures.
- Differences between heterogeneous and homogeneous mixtures.

4. **Apparatus needed:**

- Beakers - 3
- Clay mud, salt, torch bulb, spatula, soluble starch, sand
- Iron filings
- Water
- Magnet
- Funnel and filter paper
- Hot plate
- Tripod stand
- Gas torch

5. **Activity 1: Separation of mixtures**

5.1 **Note to the Teacher**

Before commencing with this activity, the teacher has to elicit the prior understanding of the students pertaining to the content—their understanding of mixtures and separation techniques. The students need to understand that different separation techniques are employed to separate mixtures based on the properties of the substance, such as solubility, magnetic property, size of the particles, etc.

5.2. **Procedure:**

The teacher should hand over a mixture of camphor powder, sand, iron filings, and common salt that has been prepared before to the students. The students can be divided into groups of four. The experiment involves boiling and sublimation.

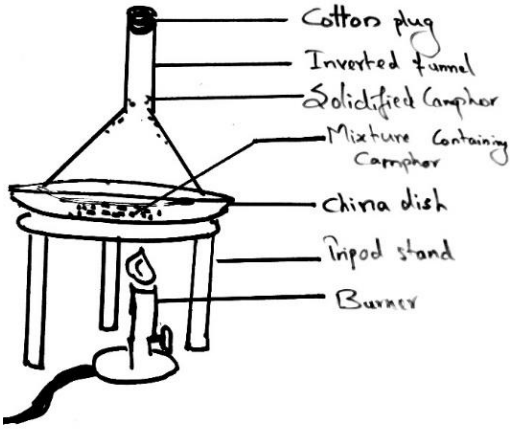
From the mixture, the iron filings need to be separated first using magnetic separation. This is followed by separating the camphor through sublimation. The mixture should then be dissolved in water and filtered to separate sand and then evaporated to obtain the salt.

5.2.1 **Separation of Iron Filings**

Take the mixture in a china dish. Use a magnet to separate the iron fillings from the mixture. This step has to be repeated 2–3 times to separate all the iron filings.

5.2.2 **Separation of Camphor**

i. Place the china dish on a wire gauze, which is placed on top of a tripod stand.
ii. Cover the china dish with an inverted glass funnel and place a little cotton at the opening of the stem of the funnel.
iii. Heat the mixture over a flame until white fumes evolve and rise inside the funnel.
iv. Stop heating when the white fumes stop rising and allow the funnel to cool.
v. Remove the funnel from over the china dish once the mixture has cooled down and, using a spatula, transfer the solid camphor sticking to the walls of the funnel into a watch glass.



5.2.3 **Separation of Sand Particles**

Transfer the contents of the china dish into a beaker. Pour some distilled water into the beaker and stir it well using a glass rod. Filter the contents of the funnel into another beaker. Transfer the sand particles that will be left behind on the filter paper into a watch glass using a spatula.

5.2.4 **Separation of Salt**

Transfer the filtrate in the beaker onto a china dish and heat it strongly. After some time, the salt will be left as a residue on the china dish; transfer it into another watch glass.

Worksheet for the students to fill during the procedure:

Substance	Separation Method	Inference
Iron Filings		
Camphor		
Sand		
Salt		

Finally, label the three components that have been separated from the mixture.

6. **Activity 2: Preparation of colloids and checking their properties.**

6.1 **Note to the Teachers:**

Before conducting this activity in the classroom, the teacher must introduce the terms “dispersed phase” and “dispersion medium” with examples.

Example:

- In a starch solution, the starch represents the dispersed phase, while the water represents the dispersion medium.
- In a clay solution, the clay represents the dispersed phase, while the water represents the dispersion medium.

The colloidal particles become self-luminous due to the absorption of light energy, which is then scattered from their surface. This phenomenon is called the “Tinder effect”. The intensity of the scattered light depends on the type of colloidal solution and the size of the colloidal particles. The difference between suspensions and colloids lies in their difference in size at the dispersed phase—suspensions are larger than 1,000 nanometers and colloids range in size between 1 and 1,000 nanometers. As for example, milk and mayonnaise are white, ocean is blue.

6.2. **Procedure:**

Take three beakers containing water, which will be the dispersion medium. Put some salt, clay, and starch powder in each beaker and stir it well. Now, take the torch and pass light through the mixtures and observe the transparency of the solution. Write some letters on a white paper and place it under the beaker. The students are to fill up the worksheet given below by noting down their observations and inferences.

Worksheet for the students to fill during the procedure:

When we added salt in the water, no salt was left behind. Where did the salt go?
When we added clay mud into the second beaker, what did you observe? Why doesn't clay mud act like salt?
Why do you think starch solutions have a milky white color?

Solution	Dispersed phase	Dispersion medium	Tinder effect- (Light passes through or not)
Clay solution			
Salt solution			
Starch Solution			

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Post-class Assessment:
Marks 10
Time: 15 minutes

I. Choose the correct answer: (6)

1. When we mix a drop of ink in water, we get a _____.

a) Heterogeneous Mixture b) Homogeneous Mixture

c) Compound d) Suspension

2. Through which solution can light pass freely?

a) Muddy water b) Chalk-powder solution

c) Salt solution d) Starch solution

3. _____ has the same properties throughout its sample.

a) Pure substance b) Mixture

c) Colloid d) Suspension

4. Which of the following best describes a chemical mixture?
   a. A compound that is made from different elements
   b. A substance that is made by chemical bonding
   c. When two substances are combined but are not chemically bonded
   d. All the above

5. Which of the following is an example of a homogeneous mixture?
   a. Salt-water
   b. Metal alloys
   c. Air
   d. All the above

6. Filtration method is effective in separating a _____ mixture.

a) Solid-solid b) Solid-liquid

c) Liquid-liquid d) Liquid-gas

II. Match the following: (4)

Substance	Separation Method
1. Iron	a) Filtration
2. Camphor	b) Magnetic separation
3. Salt	c) Sublimation
4. Tea powder	d) Dissolving followed by evaporation