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Materials and Solutions



You have already studied in Class 3 that if we add a teaspoon of salt to a glass of clean water and stir the water continuously, then after some time the salt seems to disappear. We say that the salt has dissolved in water. Water and salt together form a solution. Thus, when two or more substances mix together and are evenly distributed, a solution is formed.

Learn about

- Solute, solvent, and solution
- Soluble and insoluble substances
- Methods of separation of soluble and insoluble substances

Let us learn more about solutions and the different methods used to separate its components.

► Solute, Solvent, and Solution

A solution is formed when two or more substances are mixed together, and they dissolve. These substances are called the components of the solution.

- *The substance that dissolves is called the **solute**.*
- *The substance in which the solute dissolves is called the **solvent**.*
- Water is called the **universal solvent** because most substances dissolve in it.

*A solute and a solvent together form a **solution**.*



Salt in water makes a solution.

Think and Discuss

The amount of solute is always less than the amount of solvent. Think and discuss what will happen if we keep on increasing the amount of solute in a solution.



In the picture given above, we can see that salt is the solute, clean water is the solvent, and the salty water obtained after dissolving the salt in water is the solution.

The table given below shows some other examples of making solutions by using different solutes and solvents.

Table 1 Solutions that we make in our day-to-day life

Solution	Lemon juice	Jaljeera drink	Coffee	Milkshake
Solute	Lemon juice + sugar	Jaljeera powder + salt + lemon juice	Sugar + coffee powder	Sugar + milkshake powder (strawberry/pistachio nut)
Solvent	Water	Water	Milk	Milk
Method of preparation	Add lemon juice and sugar to water and stir.	Add Jaljeera powder, salt, and lemon juice to water, and stir.	Add sugar and coffee powder to boiled milk, and stir.	Add sugar and milkshake powder to boiled milk, and stir.

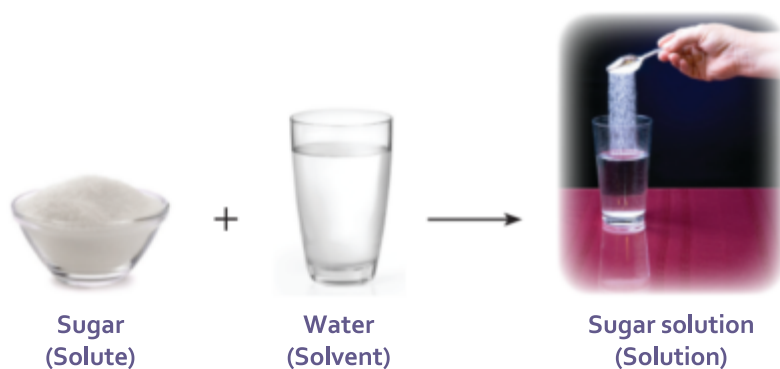
► Soluble and Insoluble Substances

*Substances that dissolve completely in a liquid to form a solution are called **soluble substances**.* For example:

- Sugar and salt are soluble in water.
- Gases, such as oxygen and carbon dioxide, are soluble in water.

Fact File

- Aqua-regia is a solvent which can dissolve noble metals like gold and platinum.
- Carbonated beverages are made by dissolving carbon dioxide gas into liquids at high pressure.



Sugar is soluble in water.



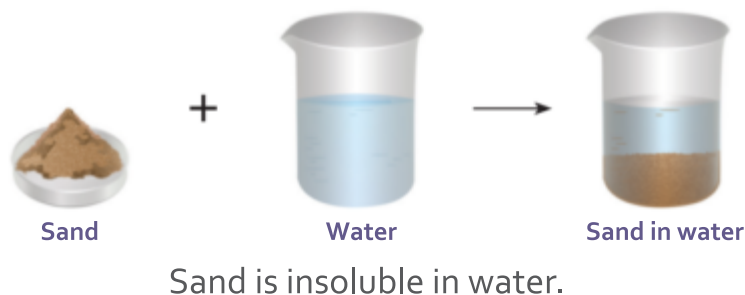
Carbon dioxide is mixed in fizzy drinks.

When two liquids mix together, such that they dissolve completely in each other, they are called **miscible liquids**. For example:

- Alcohol and water
- Orange juice and water

Substances that do not dissolve in a liquid are called **insoluble substances**. For example:

- Sand, chalk, wood, and wax are insoluble in water.
- Gases such as hydrogen, nitrogen, and helium are insoluble in water.



When two liquids are mixed, but they do not dissolve completely in each other, they are called **immiscible liquids**. For example:

- Water and oil
- Water and diesel

When two immiscible liquids are mixed, the lighter liquid floats on the top of the heavier liquid. So, when oil is mixed in water, oil being lighter, floats on the surface of water.



► Methods of Separation of Soluble and Insoluble Substances



Separation of Soluble Substances

Evaporation Soluble substances can be separated from a solution by **evaporation**. For example, we can obtain salt from a salt solution by evaporating the water (solvent).

Separation of Insoluble Substances

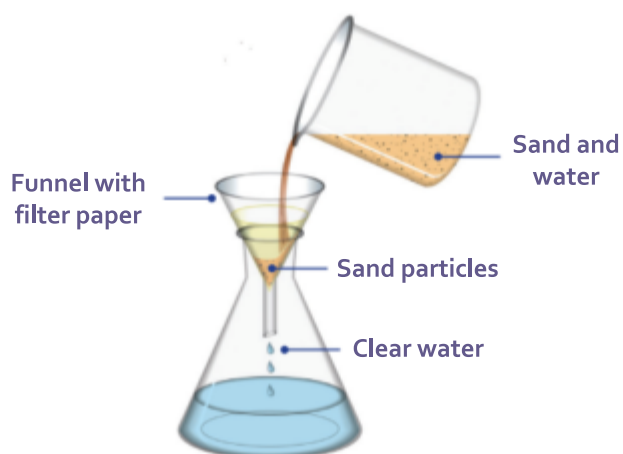
Insoluble substances can be separated from a liquid by the processes of filtration, sedimentation, and decantation.

Filtration In this process, the liquid containing insoluble substances is



Seawater contains water, salt, and a few other things. To obtain salt from it, a series of methods are used. The first step is to heat the water until it evaporates and leaves the salt behind.

poured onto a moistened filter paper¹ placed inside a funnel. The liquid passes through the filter paper, whereas the insoluble substances are left behind on the filter paper. For example, filtration can be used to separate sand from water. Sand particles, being bigger in size, cannot pass through the filter paper and are left behind on it. Water, on the other hand, easily passes through the filter paper.



Sand and water can be separated by filtration.

Activity



Aim: To demonstrate soluble and insoluble substances in a solvent and separate them by the method of filtration

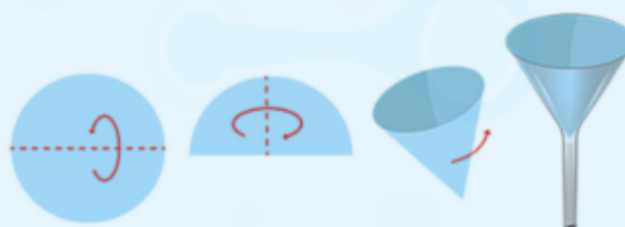
Materials required: Salt (1 teaspoon), sand (1 teaspoon), water, a glass, a funnel, filter paper, and a spoon

Procedure:

1. Take a glass of water. Add a teaspoon of salt to it and stir it well. Can you see the salt inside the glass, now? Note your observations.



2. Take a funnel and place a filter paper on it (see the figure alongside to know how to fold a filter paper and place it on the funnel).



How to fold a filter paper

¹filter paper: a paper that has very tiny holes and works like a sieve

3. Moisten the filter paper and use it to strain the solution obtained above.
4. Observe what is left on the filter paper. Dry the filter paper and note your observations.
5. Refill the glass with water.
6. Now add a teaspoon of sand to it and stir it well. What do you observe? Does the sand disappear? Note your observations.
7. Repeat the above steps of filtration and note your findings.

Observation: The salt dissolves in water and forms a solution. So, nothing is left behind on the filter paper when the salt solution is filtered.

Whereas, sand does not dissolve in water. The particles of sand are bigger than the particles of salt and thus can be separated by the process of filtration using a filter paper. So, sand is left behind on the filter paper when sand solution is filtered.

Conclusion: Salt is a soluble substance while sand is an insoluble substance.

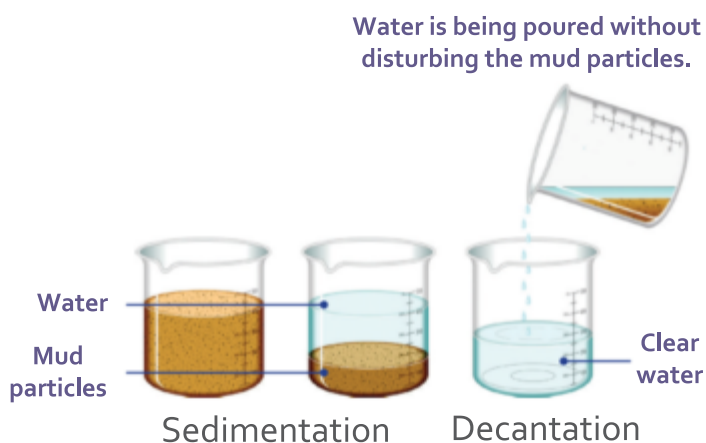
Extension: Likewise, we can also test whether substances such as sugar, soil, chalk, and flour, are soluble or insoluble in water.



Filtration of a mixture of sand and water

Sedimentation and decantation

During sedimentation, the liquid containing insoluble substances is allowed to stand undisturbed in a container for some time. The heavy, insoluble substances (impurities) settle down at the bottom of the container. *The process in which insoluble impurities settle down is called **sedimentation**.*



Now, the clear liquid is poured out very gently into another container without disturbing the impurities. *The process in which the liquid is gently poured out after sedimentation is called **decantation**.* Sedimentation and decantation can be used to separate mud from water.

Case Study

Raman, a class 4 teacher, brought powdered soap, sand, and tea leaves to his class to explain soluble and insoluble substances. He asked three of his students, Shravan, Nilesh, and Rani, to take these materials and mix them in separate glasses of water.

Shravan mixed a teaspoon of powdered soap to a glass of water.

Nilesh mixed a teaspoon of sand in a glass of water.

Rani added a tablespoon of tea leaves to a glass of water and stirred it properly.

Based on the above information, answer the following questions:

- Of the three students, who will get a solution?
- Of the three students, who can separate the components using filtration?
- Of the three students, who can separate the components using sedimentation and decantation?

Questions



Match the following.

Column A

- Salt in water
- Water and alcohol
- Oil and water
- Salt from sea water
- Chalk in water

Column B

- Immiscible liquids
- Insoluble substance
- Evaporation
- Solution
- Miscible liquids

Wrap Up

- Solute is the substance that gets dissolved to form a solution.
- Solvent is the substance into which the solute dissolves to form a solution.
- A solution is formed when two or more substances are mixed together and they dissolve.
- Soluble substances can be separated by heating or evaporating the solution.
- Insoluble substances can be separated through the following methods:
 - Filtration: In this process, the liquid containing insoluble substances is poured through filter paper for separation.
 - Sedimentation: In this method, insoluble impurities settle down when allowed to stand for sometime.
 - Decantation: In this method, the liquid is gently poured out after sedimentation.

Exercises

SECTION I



A Choose the correct option.

- Which of the following is/are the components of a solution?
a. solute b. solvent c. both of these d. none of these
- In sugar solution, water is the
a. solute b. solvent c. solution d. insoluble substance
- can be used to separate sand from water.
a. Freezing b. Melting c. Condensation d. Filtration
- We can get salt from salt solution by
a. evaporation b. decantation c. condensation d. filtration

B Assertion and Reasoning questions.

- Assertion (A):** When salt is mixed with water, its particles settle down at the bottom of the container.
Reason (R): Salt is insoluble in water.
a. Both A and R are True b. Both A and R are False
c. A is True and R is False d. A is False and R is True
- Assertion (A):** The process in which insoluble particles settle down is filtration.
Reason (R): The clear liquid is then transferred to another container.
a. Both A and R are True b. Both A and R are False
c. A is True and R is False d. A is False and R is True

C Write T for True and F for False. Correct the False statements.

- Oil is a universal solvent.
- The substance in which a solute dissolves is called a solvent.
- Filter paper is used for filtration.
- Soluble substances can be separated from a solution by heating the solution.
- Salt is obtained from river water.

D Give two examples of the following.

- Soluble substances
- Substances that can be separated through filtration

3. Miscible liquids
4. Immiscible liquids

E **Name the following.**

1. A way of separating soluble substances
2. A solute and a solvent together form this
3. The universal solvent
4. The process in which the insoluble impurities settle down



SECTION II

F **Short answer questions.**

1. Differentiate between soluble and insoluble substances.
2. Differentiate between miscible and immiscible liquids.
3. Name a method used to separate salt from a salt solution.
4. What will happen if you put oil in water?


G **Long answer questions.**

1. During summer vacations Rishi likes to drink coolers. A cooler contains mint leaves, lemon juice, salt, and water. Explain the terms solute, solvent, and solution, using this example.
2. Explain the process of filtration with the help of a suitable diagram.
3. Explain the process of sedimentation and decantation. Draw suitable diagrams.

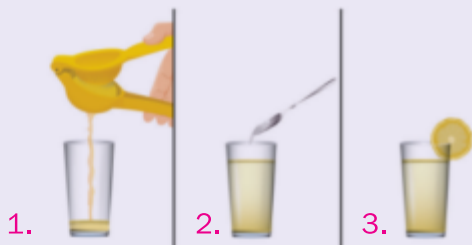
Picture Study



1 **Look at the three pictures given below and complete the table.**

	Picture	Solute	Solvent	Solution
a.	 <p>1. 2. 3.</p> <p>Steps for preparing sweet milk in a glass</p>			

b.



Steps for preparing lemon juice

c.

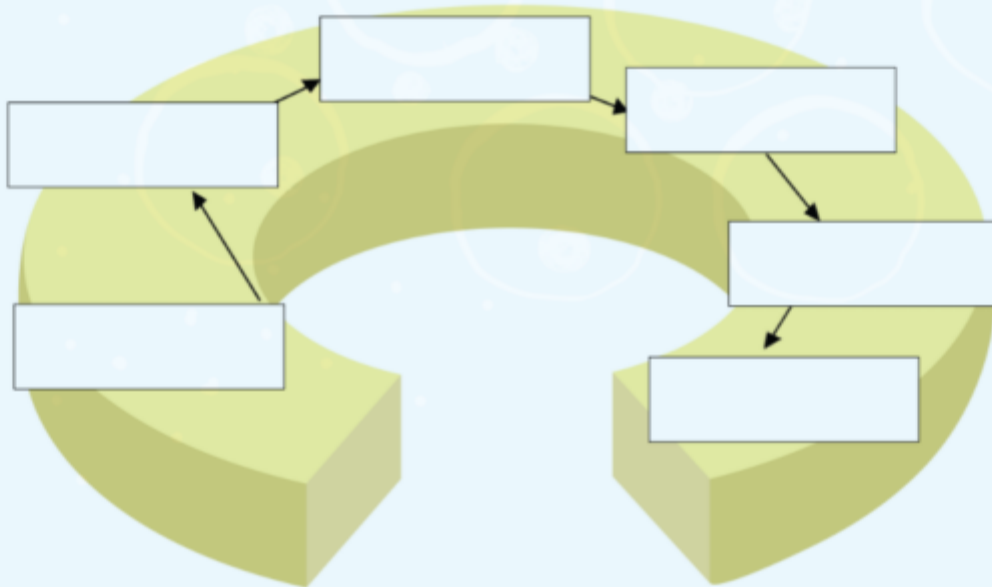


Steps for preparing tea

2

Sonam's mother is preparing kulfi.

Select suitable labels from the Helpbox, and write them in the boxes and on arrows to describe all the steps involved in the preparation of kulfi.



Sugar
Pistachio

Milk
Almond

Garnish
Kulfi mould

Boil
Freeze

Mix slices of cashew nuts
Condensed milk



My Learning Corner

A Think about

1. In the method of filtration, we use filter paper for filtering. Mention an example where we use this technique in our day-to-day life. What do we use in place of filter paper for filtering?
2. Which is the better method of purification—filtration or sedimentation followed by decantation? Give reasons.
3. Ravi asks his teacher, "Ma'am, is the coffee that mother prepares, a solvent or a solution?" Write what the teacher could have answered.

B Try out

1. In your Science Scrapbook, make a list of various solutions that we generally prepare in our day-to-day life. You can also paste pictures and present the content in a tabular form as given below. Also, mention the solute and the solvent in it. You can take help from your elders, teachers, and the Internet.

Picture	Solute	Solvent	Solution
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2. Perform the following activities with the help of your teacher. Write them down in your Science Scrapbook. (Mention the aim, observation, and conclusion.)
 - a. Process of **sedimentation and decantation**:
 - i. Sand in water
 - ii. Clay in water
 - b. Separation of insoluble substances from a liquid by **filtration** (for example, separation of sand from muddy water)
 - c. Separation of soluble substances from a solution by **evaporation** (for example, separation of salt from salt water)

Self-Assessment

Now that you have completed the chapter, score each of the following tasks from 1 to 5 to indicate how well you can do them.

Score 5 = I can definitely do this.

Score 1 = I cannot do this yet.

I can...	My score
• define the terms solute, solvent, and solution.	
• explain what are soluble and insoluble substances.	
• explain and demonstrate the methods of separation of soluble and insoluble substances.	

Worksheet



Pictures of different substances, along with their jumbled names are given below. Unjumble them, write their states, and mention whether they are soluble or insoluble in water.

	Picture	Unjumble the names	States of matter	Soluble/insoluble in water
1.		<div>H L C K A</div> <div></div>	.....	.....
2.		<div>L O F R U</div> <div></div>	.....	.....
3.		<div>U A S G R</div> <div></div>	.....	.....
4.		<div>I L O</div> <div></div>	.....	.....
5.		<div>A W X</div> <div></div>	.....	.....
6.		<div>A T S L</div> <div></div>	.....	.....

