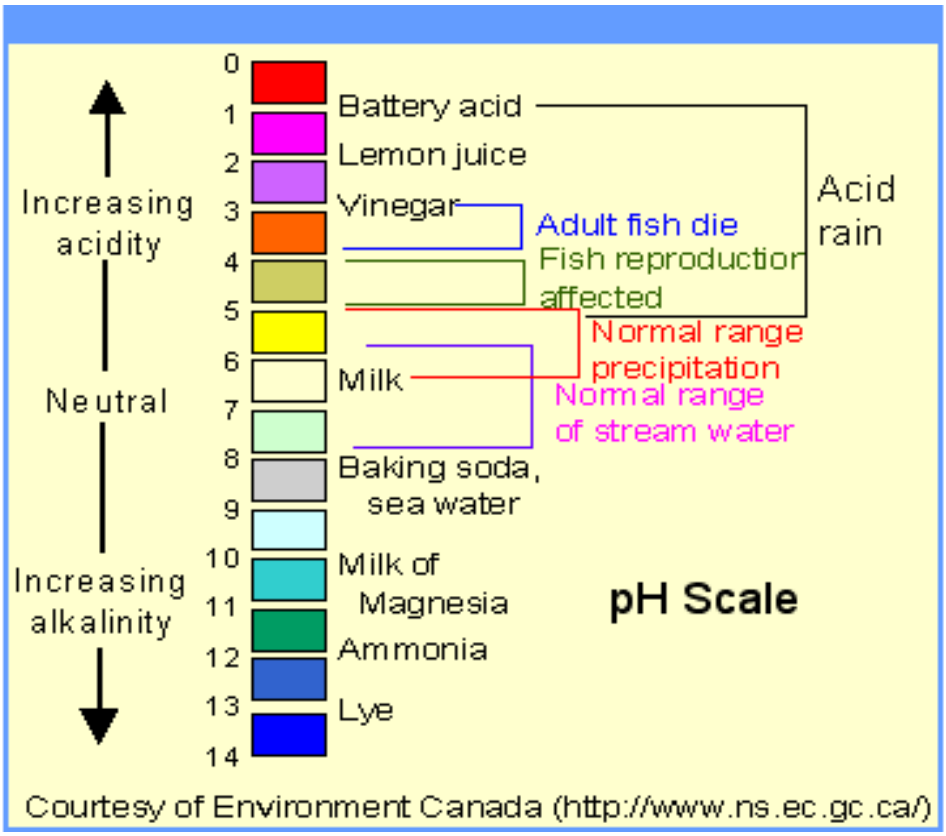
pH Scale by Romania Team

- **Acidic and basic are two extremes that describe a chemical property chemicals. Mixing acids and bases can cancel out or neutralize their extreme effects. A substance that is neither acidic nor basic is neutral.**
- **The pH scale measures how acidic or basic a substance is.**
- **The pH scale ranges from 0 to 14.**
- **A pH of 7 is neutral.**
- **A pH less than 7 is acidic.**
- **A pH greater than 7 is basic.**

The pH inside human cells (6.8) and the pH of blood (7.4) are both very close to neutral. Extreme pH values, either above or below 7.0, are usually considered unfavorable for life.



Student Objectives

- Use supporting evidence to predict if common household substances are acids or bases.
- Determine the pH of the substances.
- Describe the results of the investigation and characteristics of each substance.

Materials

- pH meter (if available)
- plastic cups (to hold the materials to be tested)
- distilled water
- lemon juice
- vinegar

- baking soda
- ammonia
- phenolphthalein (if available)

Procedure

. One student from each group can come up to a central area to collect the materials, or you can hand out the materials to each group. Each group will need the following materials:

- samples of these materials in a cup: distilled water, lemon juice, vinegar, baking soda, and ammonia
- pH meter (if available)
- Tell students that they are going to measure the pH of common household substances to determine if they are acids or bases. Explain that pH is measured on a scale of 0-14. Substances with a pH lower than 7 are acids; those with a pH higher than 7 are bases; and a substance with a pH of 7 is neutral
- In laboratory settings, **a pH meter** is used to measure the pH of a liquid. The probes of the pH meter are simply dipped into the liquid and the pH level is given on a digital screen. This is a much more precise measurement of pH than using pH papers.
- Determine the pH of each material. Record the pH on a chart, indicating whether the material is an acid or a base.
- Students may present their findings to their classmates and compare their results

Observations

Natural Fruit and Vegetable Indicators	pH meter
Apple skin (Red)	
Red cabbage	
Potatoes juice	
Lemon juice	
Oranges	
Red onions	
Milk	
Peanut butter	
Tea	
Vinegar	
Water drinking	
Tomatoes	
Meat	
Cucumber	

Context: Soap and other bases have a bitter taste, feel slippery to the touch, and do not react when combined with most metals.

indicator

Definition: A material that has the property of changing color in the presence of an acid or a base

Context: Litmus paper is an indicator; it turns from blue to red in the presence of an acid and from red to blue in the presence of a base.

pH

Definition: A scale that measures the concentration of hydrogen ions in a solution

Context: In general, acids have a pH below 7; bases a pH above 7; and neutral solutions a pH of 7.

Watch this video:

https://www.youtube.com/watch?v=REBBsTIKWbI

Making a pH indicator by Romanian Team

- Some substances are classified as either an acid or a base. Think of acids and bases as opposites—**acids have a low pH and bases have a high pH.**
- For reference, water (a neutral) has a pH of 7 on a scale of 0–14. Scientists can tell if a substance is an acid or a base by means of an **indicator**.
- **An indicator** is typically a chemical that changes color if it comes in contact with an acid or a base.

- As you can see, the purple cabbage juice turns **red** when it mixes with something **acidic** and turns **green** when it mixes with something **basic.**

- Red cabbage juice is considered to be an indicator because it shows us something about the chemical composition of other substances.

Materials You Will Need

- Red cabbage
- Blender or knife
- Boiling water
- Filter paper
- One large glass beaker or another glass container
- Glasses with purple cabbage juice.
- Some drops of differents substances

Red Cabbage pH Indicator Colors

pH	2	4	6	8	10	12
Color	Red	Purple	Violet	Blue	Blue-Green	Greenish Yellow

Materials You Will Need

- Red cabbage
- Blender or knife
- Boiling water
- Filter paper
- One large glass beaker or another glass container
- Glasses with purple cabbage juice.
- Some drops of differents substances

Procedure

1. Chop the cabbage into small pieces and you can place about 2 cups of cabbage in a blender, cover it with boiling water, and blend it.

1. Filter out the plant material to obtain a red-purple-bluish colored liquid. This liquid is at about pH 7. **This filtered juice is your pH indicator.**
2.
3. Fill additional glasses with purple cabbage juice and add drops of that substances**:**
    1. *the lemon or lime juice solution*
    2. *the vinegar solution*
    3. *baking soda*
    4. Washing soda
    5. Black coffee
    6. Distilled water
    7. window cleaner
    8. Sprite
    9. fizzy water
    10. Antacids (calcium carbonate, calcium hydroxide, magnesium hydroxide)
    11. Lye (potassium hydroxide, KOH or sodium hydroxide, NaOH).

- **Observations and results**

Did the indicator solution change color when you added other substances?

Red Cabbage pH Indicator Colors

pH	2	4	6	8	10	12
Color	Red	Purple	Violet	Blue	Blue-Green	Greenish Yellow

A solution with a pH between

- 5 and 7 is neutral,
- 8 or higher is a base,
- 4 or lower is an acid

Lime juice, lemon juice and vinegar are acids, so they should have turned the indicator solution red or purple color. Bleach is a strong base, therefore it should have turned the indicator solution a greenish-yellow color.
https://www.stevespanglerscience.com/lab/experiments/red-cabbage-chemistry/

Subject: Science by Romanian Team

Topic: Water Purification

Objective / Contents: To teach children the process of Water Purification.

Methodology:

Definition of Water Purification, Why do we need to purify water, will be answered. There are 3 main steps for Water Purification:

Explanation through a experiment.

Aim: To purify the given water.

Apparatus: Funnel, Glass beakers, bottle.

Materials: Filter paper, water, mud.

Method:

- Take some muddy water in an old bottle, shake it vigorously, leave it for a day.
- Next day the water in the bottle can be clearly demarked as it's on the top and the mud and dust particles have settled (sediment) down. This is the 1st step of water purification i.e. **Sedimentation.** Insert fig 1*
- Now without shaking decant (remove) the water layer into a glass beaker. This is the 2nd step of water purification i.e. **Decantation**. Insert fig 2 **
- Now take a funnel and keep the filter paper in shape of cone, and filter the decanted water in another glass beaker. We will see that water gets filtered in the form of drops in this beaker. This drops together is called as filtrate and the dust particles remaining in the filter paper is called residue/impurities. This is the 3rd step of water purification i.e. **Filtration.** Insert fig 3 ***
- **Note**: # Besides the filter paper**,** sand, gravel, clay , cotton and cloth are also used as filtering agents.

  # The water still is not free from bacteria. These bacteria can be killed by adding $KMNO_4$., Chlorine tablets , Alum or by boiling.

Sedimentation and decantation methods are used for the separation of insoluble substances which are heavier than liquid. In the sedimentation process, heavier components of the mixture settle on the bottom, due to gravity. Decantation is followed by sedimentation. The decantation process involves pouring clear, upper liquid out of the container, without

disturbing the sediment.

This process of separation of solid impurities from the liquid solution is termed as decantation.

Decantation Definition

Decantation is the process of separation of liquid from solid and other immiscible (non-mixing) liquids, by removing the liquid layer at the top from the layer of solid or liquid below. The process can be carried out by tilting the mixture after pouring out the top layer. This process can also be used to separate two liquids that do not mix with each other for e.g., oil and water. When we leave the mixture of oil and water, two separate layers are formed, with water at the bottom and oil, being lighter, at the top. We can remove the oil layer from the top by pouring it into another vessel, which leaves us with the water layer at the bottom.

Some Mixtures That Can Be Decanted

- **Oil and water** – oil floats on top of water. Decanting the mixture allows the oil to be poured off the water.

- **Dirt and water** – muddy water can be cleared up by decanting. The soil will sink to the bottom of the tube allowing the clear water to be poured off.
- **Cream and milk** – Cream is separated from milk by decantation. Cream rises to the top of the milk mixture and is easily skimmed off.

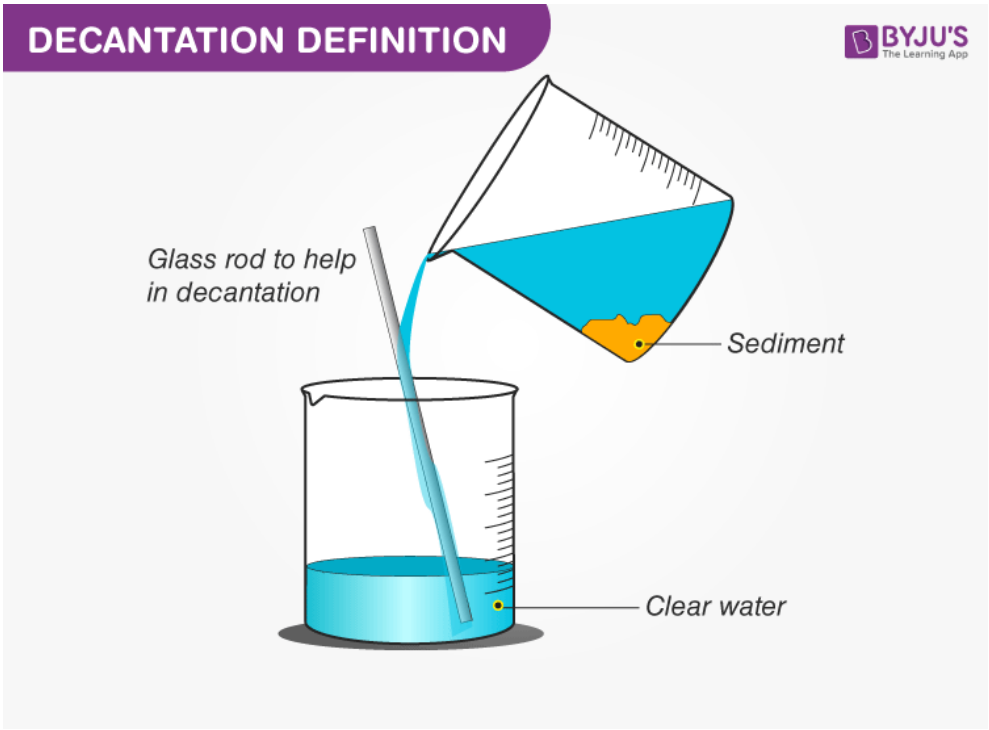
- **Blood and plasma** – A centrifuge is necessary for this decantation. Plasma can be removed from blood by decantation.
- Let us find a few other mixtures that can be separated through sedimentation and decantation.
- 

  The same principle is used for separating a mixture of two liquids that do not mix with each other. For example, oil and water from their mixture can be separated by this process. If a mixture of such liquids is allowed to stand for some time, they form two separate layers. The component that forms the top layer can then be separated by decantation.
- Let us again consider a mixure of a solid and liquid. After preparing tea, what do you do to remove the tea leaves? Try decantation. It helps a little. But, do you still get a few leaves in your tea? Now, pour the tea through a strainer.

- Did all the tea leaves remain in the strainer? This process is called filtration (Fig. 5.2). Which method of separating tea leaves from prepared tea is better, decantation or filtration?
- Let us now consider the example of water that we use. Do all of us, at all times, get safe water to drink? Sometimes, water supplied through taps may be muddy. The water collected from ponds or rivers may also be muddy, especially after rains. Let us see if we can use some method of separation to remove insoluble impurities like soil from the water.

Activity

- Collect some muddy water from a pond or a river. If it is not available, mix some soil to water in a glass. Let it stand for half an hour. Observe the water carefully and note your observations.
- Does some soil settle at the bottom of water? Why? What will you call this process? Now, slightly tilt the glass without disturbing the water. Let the water from the top flow into another glass (Fig.1). What will you call this process?



- Is the water in the second glass still muddy or brown in colour? Now filter it. Did the tea strainer work? Let us try filtering the water through a piece of cloth. In a piece of cloth, small holes or pores remain in between the woven threads. These pores in a cloth can be used as a filter.
- If the water is still muddy, impurities can be separated by a filter that has even smaller pores. A filter paper is one such filter that has very fine pores in it. (Fig.2) shows the steps involved in using a filter paper. A filter paper folded in the form of a cone is fixed onto a funnel (Fig.3). The mixture is then poured on the filter paper. Solid particles in the mixture do not pass through it and remain on the filter. Fruit and vegetable juices are usually filtered before drinking to separate the seeds and solid particles of pulp.

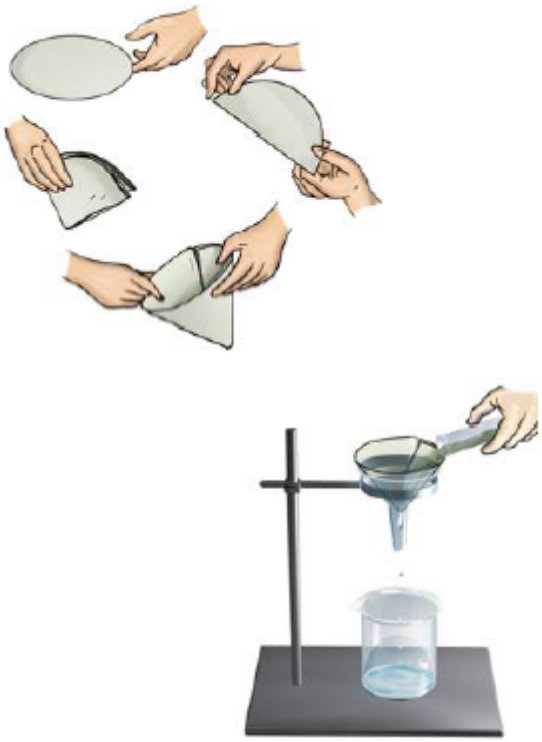


Fig.2

SUMMARY

- **In a mixture of sand and water, the heavier sand particles settle down at the bottom and the water can be separated by decantation.**
- **Filtration can be used to separate components of a mixture of an insoluble solid and a liquid.**

Sedimentation: Insoluble particles settle down at the bottom and the process is called sedimentation. For example; muddy water contains soil and sand in water. Soil and sand; being insoluble in water; settle down at bottom if water is allowed to stand for some time.

Decantation: This process is used after sedimentation. The upper layer; which contains water is slowly poured out from the container. It leaves the sediment behind.

Filtration: This method is used for separating fine insoluble solid particles from the liquid. In this process, the mixture is passed through a filter. The solid particles do not pass through the filter and clear liquid is collected.

Watch this video:

https://www.youtube.com/watch?v=pSwrV8y6pXU