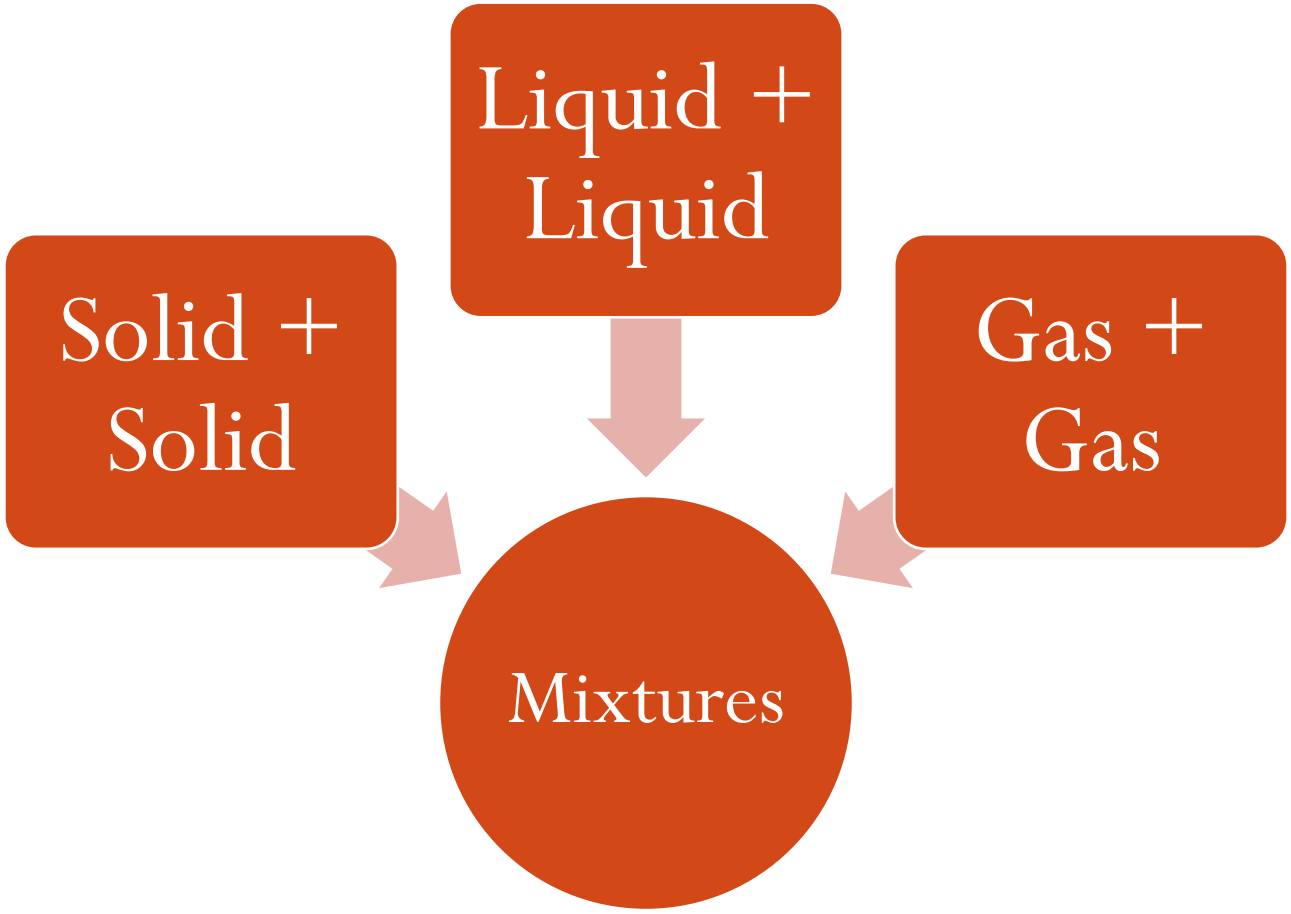
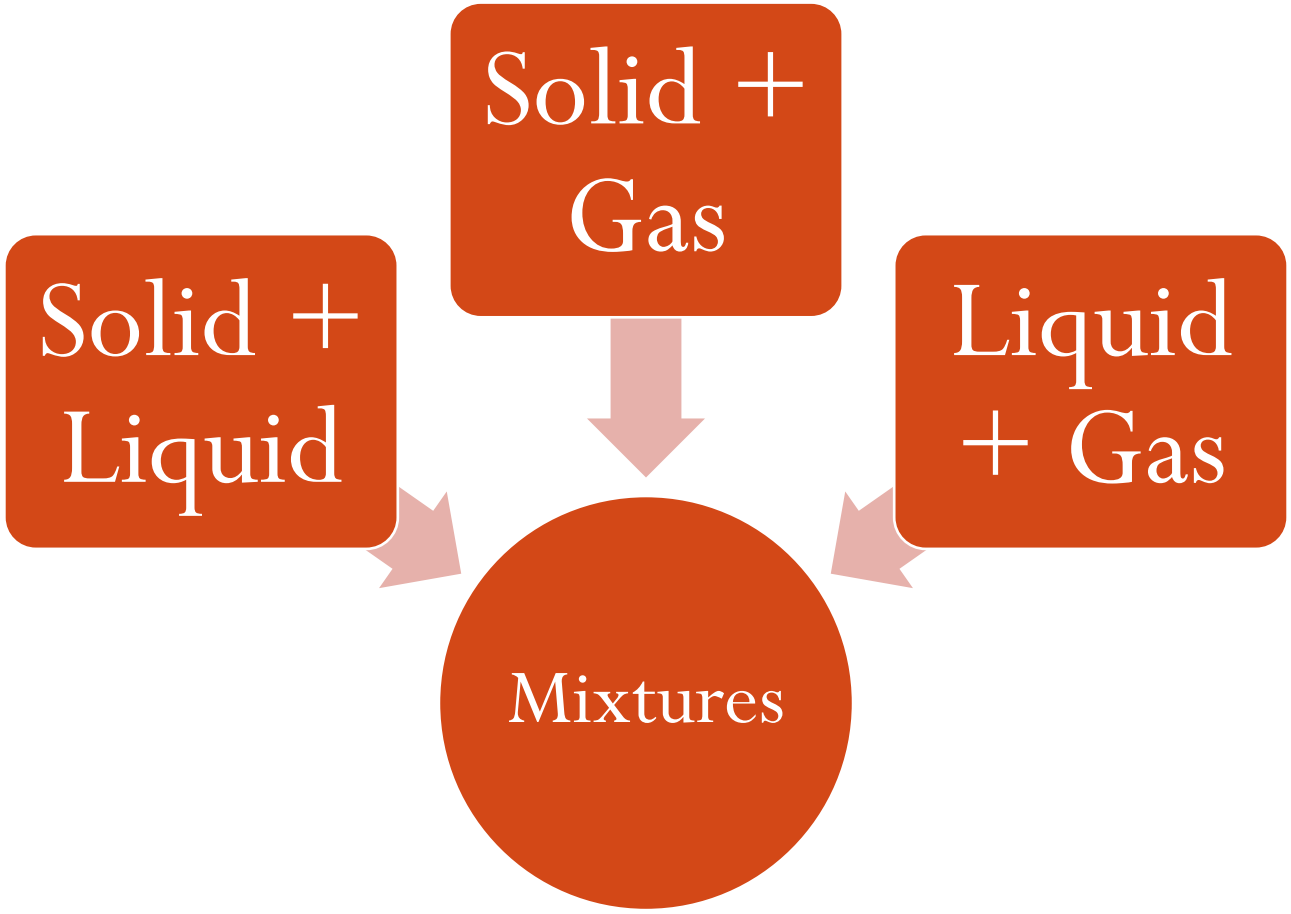
Raw Material handling & Physical Separation

Mixtures can be same phase.....



Or Mixtures can be mixed-phase



Separation of Substances (Pure Substances and Mixtures)

- A pure Substance consists of only one kind of particles.(e.g: Water)
- A mixture…..
  - consists of two or more different substances that are mixed but not chemically combined.

  - they do not have well defined specific properties.

  - can be separated into its components by physical means.

❖Types of Mixture: Two types

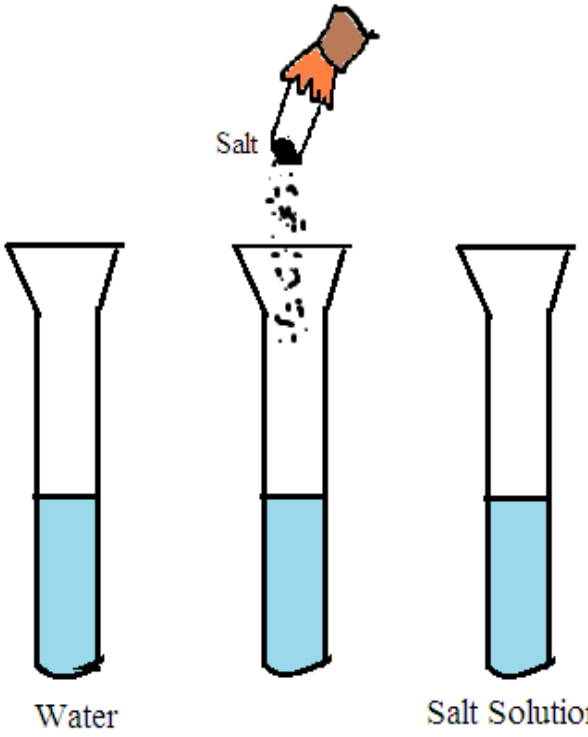
- A **homogeneous mixture** is that which has the same composition throughout, that is, its components are uniformly distributed and cannot be distinguished from each other.
- A heterogeneous mixture is that which does not have the same composition throughout, that is, its components are not uniformly distributed and can be distinguished from each other.

- Corn oil

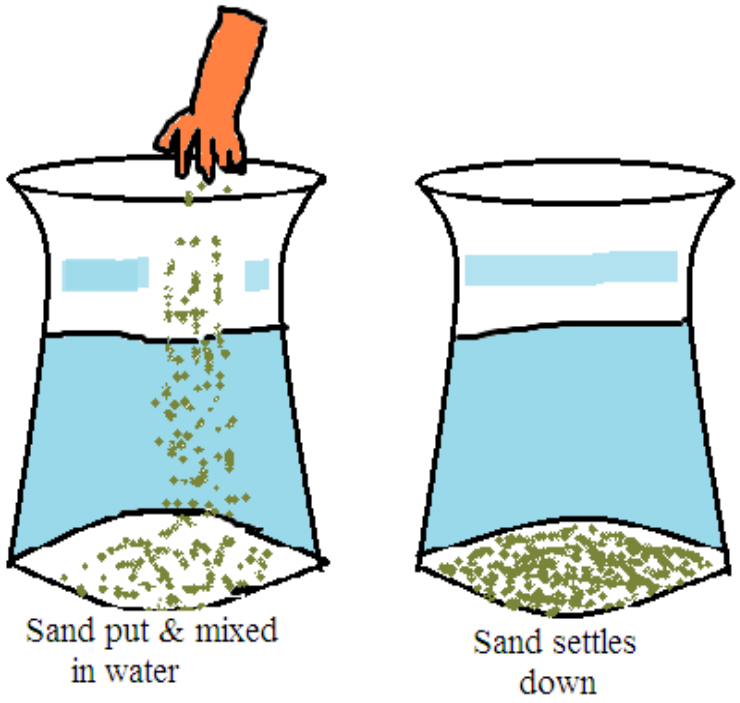
- White vinegar

- A sugar solution

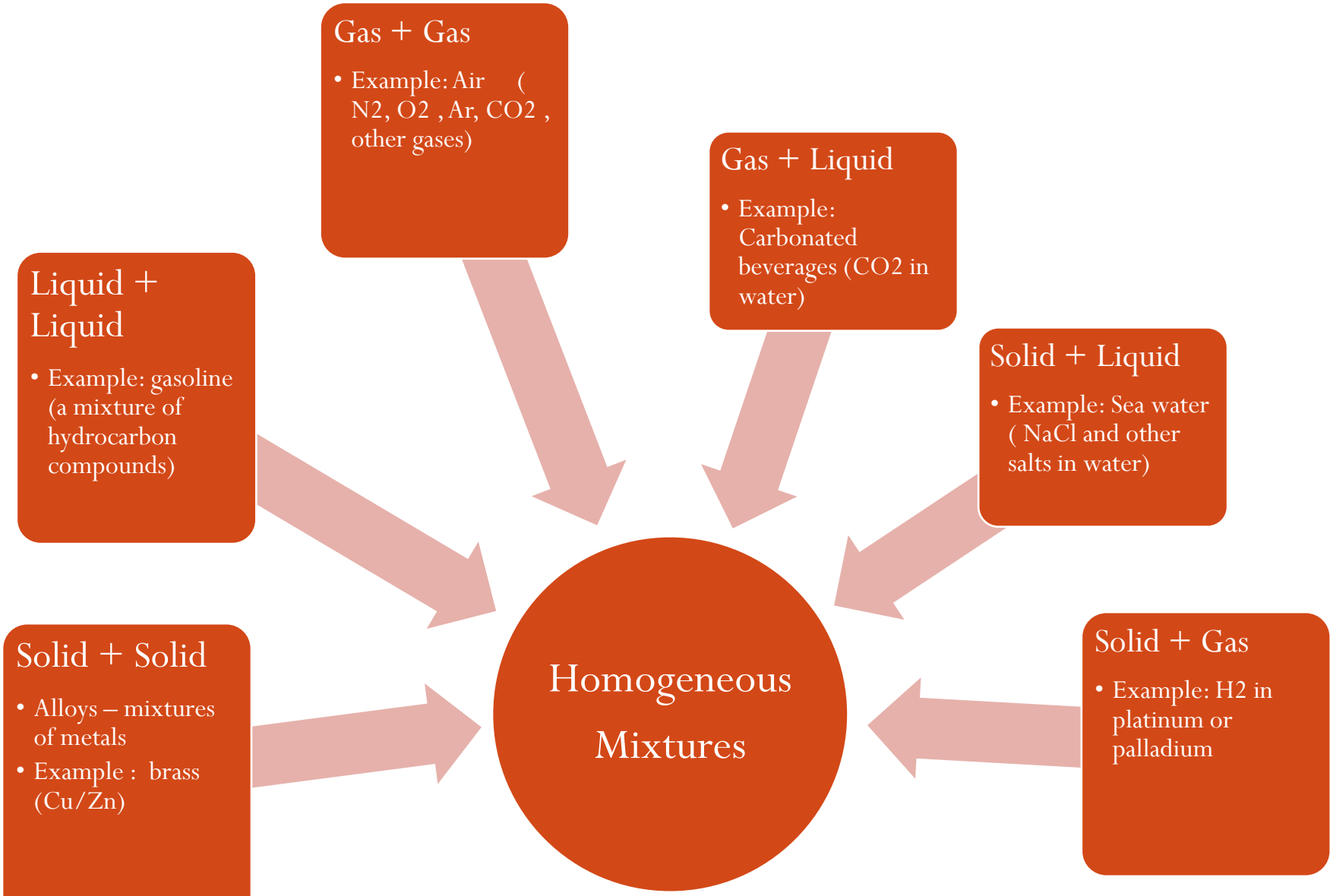
- A salt solution

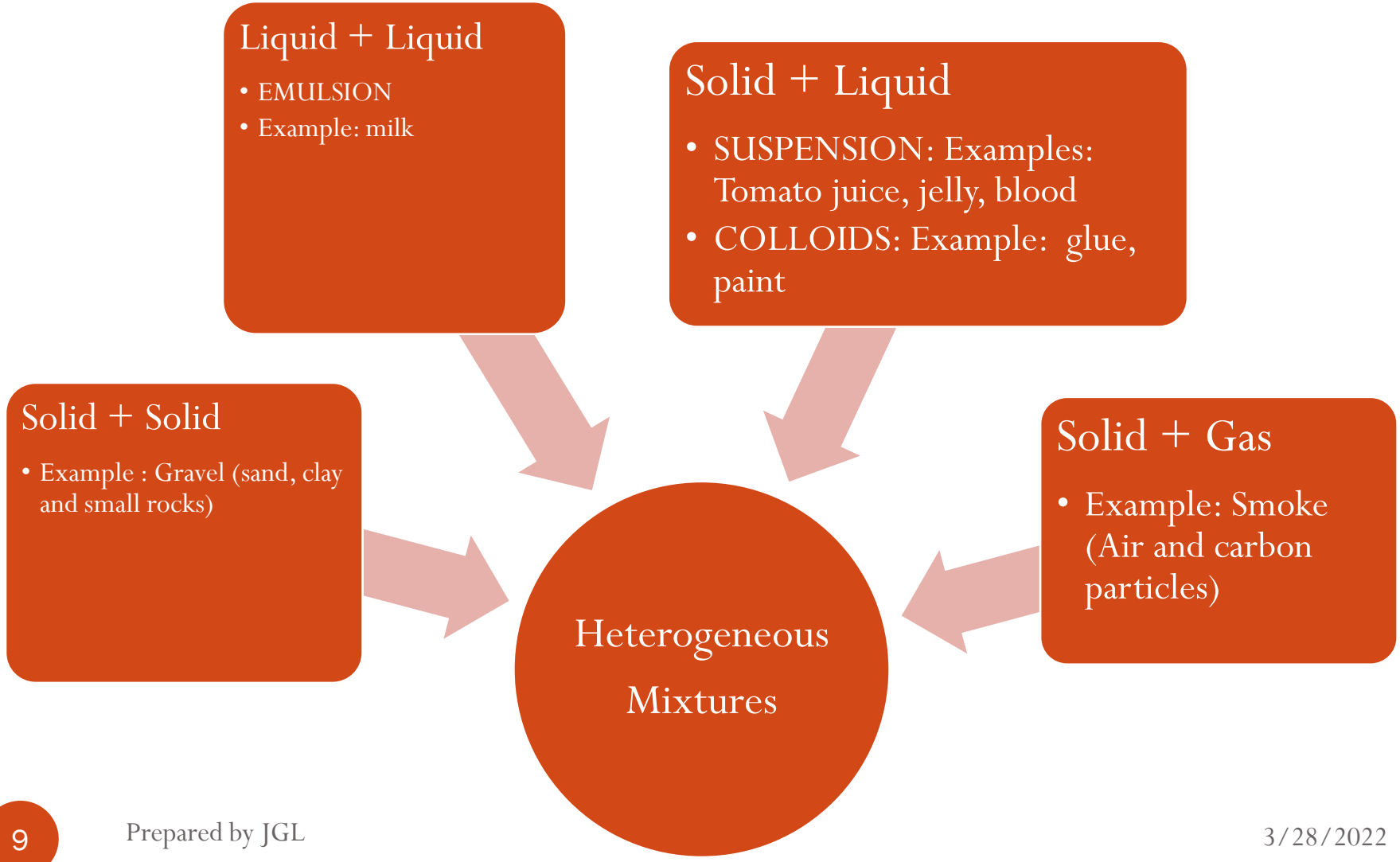


Homogeneous mixture

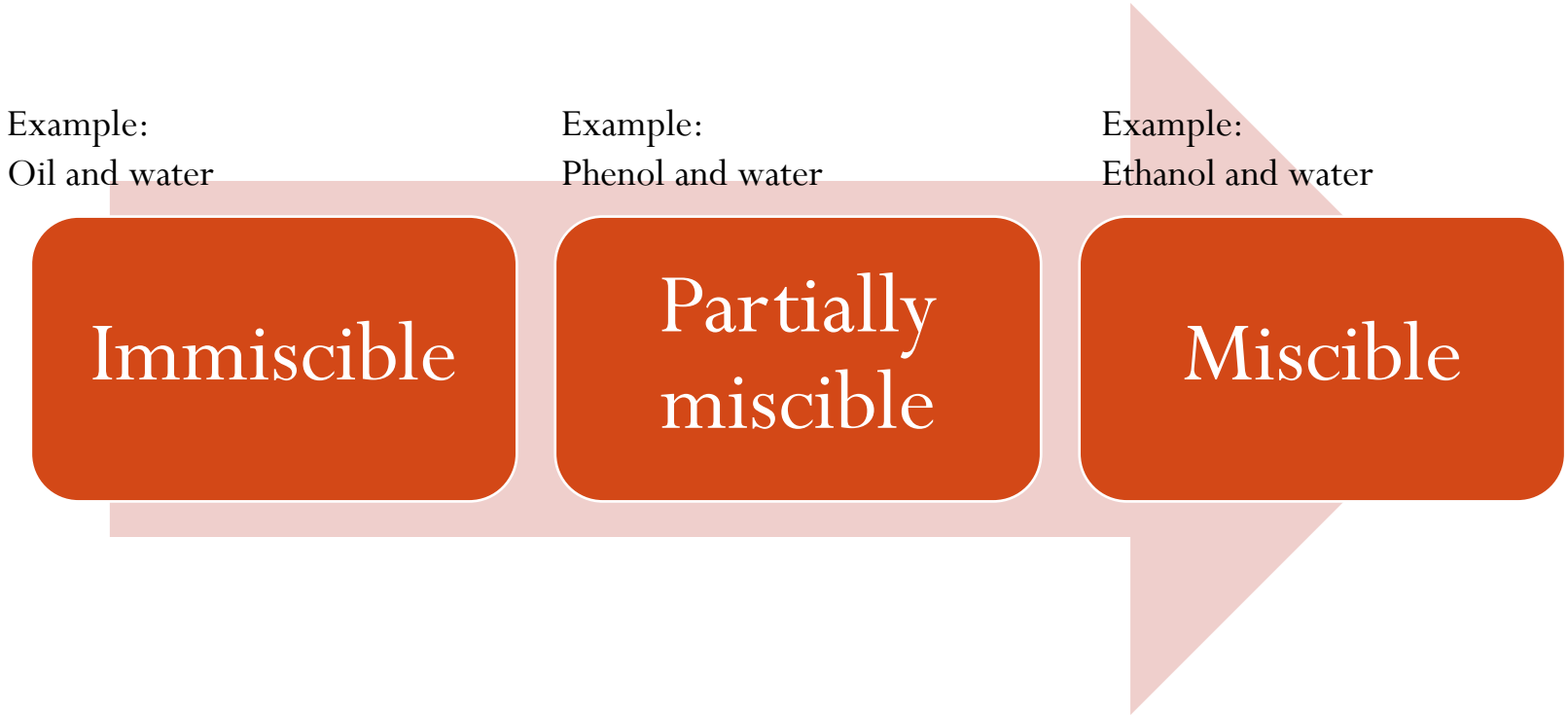


Heterogeneous mixture


Gas + Gas
• Example: Air (N2, O2 , Ar, CO2 , other gases)
Gas + Liquid
• Example: Carbonated beverages (CO2 in water)
Liquid + Liquid
• Example: gasoline (a mixture of hydrocarbon compounds)
Solid + Liquid
• Example: Sea water (NaCl and other salts in water)
Homogeneous Mixtures
Solid + Solid
• Alloys – mixtures of metals
• Example : brass (Cu/Zn)
Solid + Gas
• Example: H2 in platinum or palladium

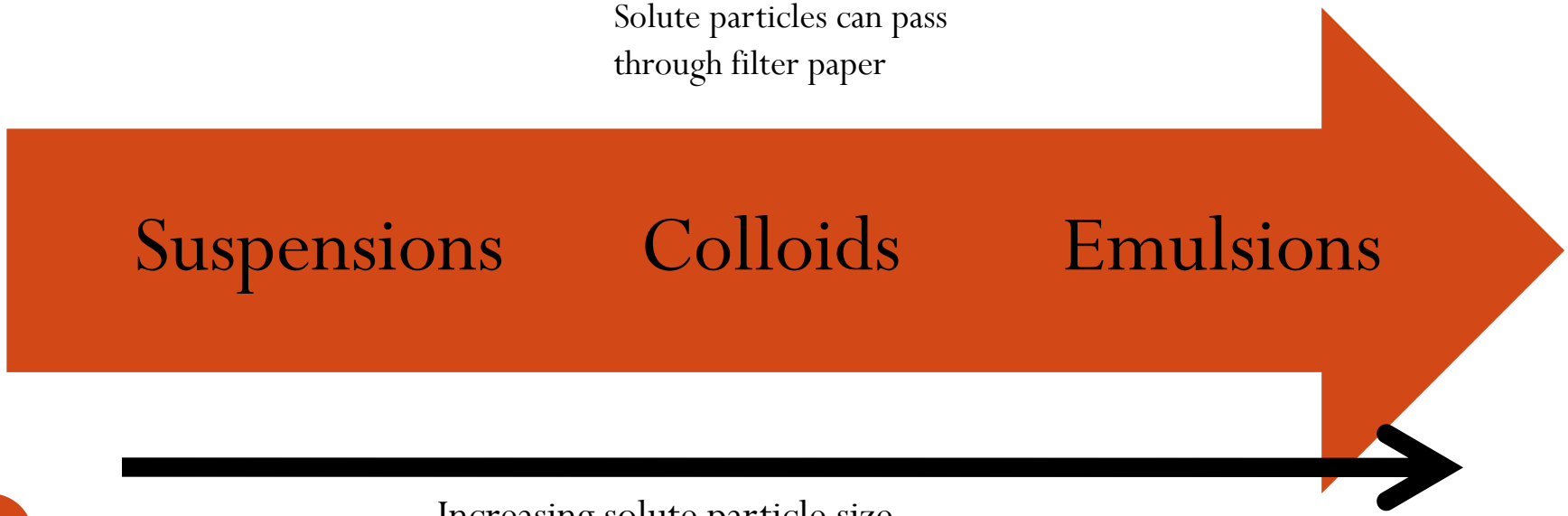

Liquid + Liquid
• EMULSION
• Example: milk
Solid + Liquid
• SUSPENSION: Examples: Tomato juice, jelly, blood
• COLLOIDS: Example: glue, paint
Solid + Solid
• Example : Gravel (sand, clay and small rocks)
Solid + Gas
• Example: Smoke (Air and carbon particles)
Heterogeneous Mixtures

Liquid-Liquid solutions

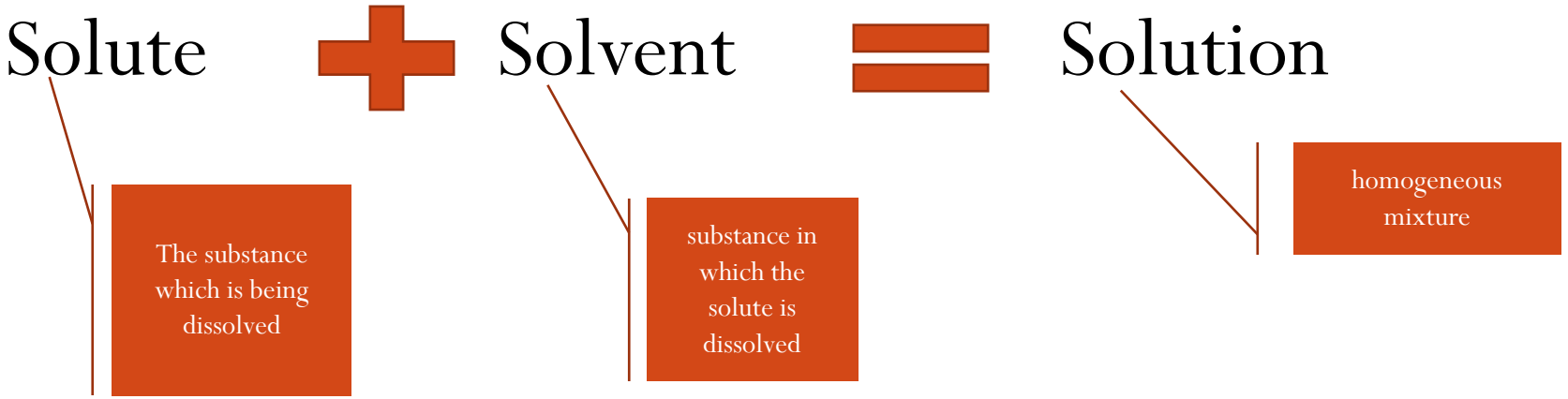


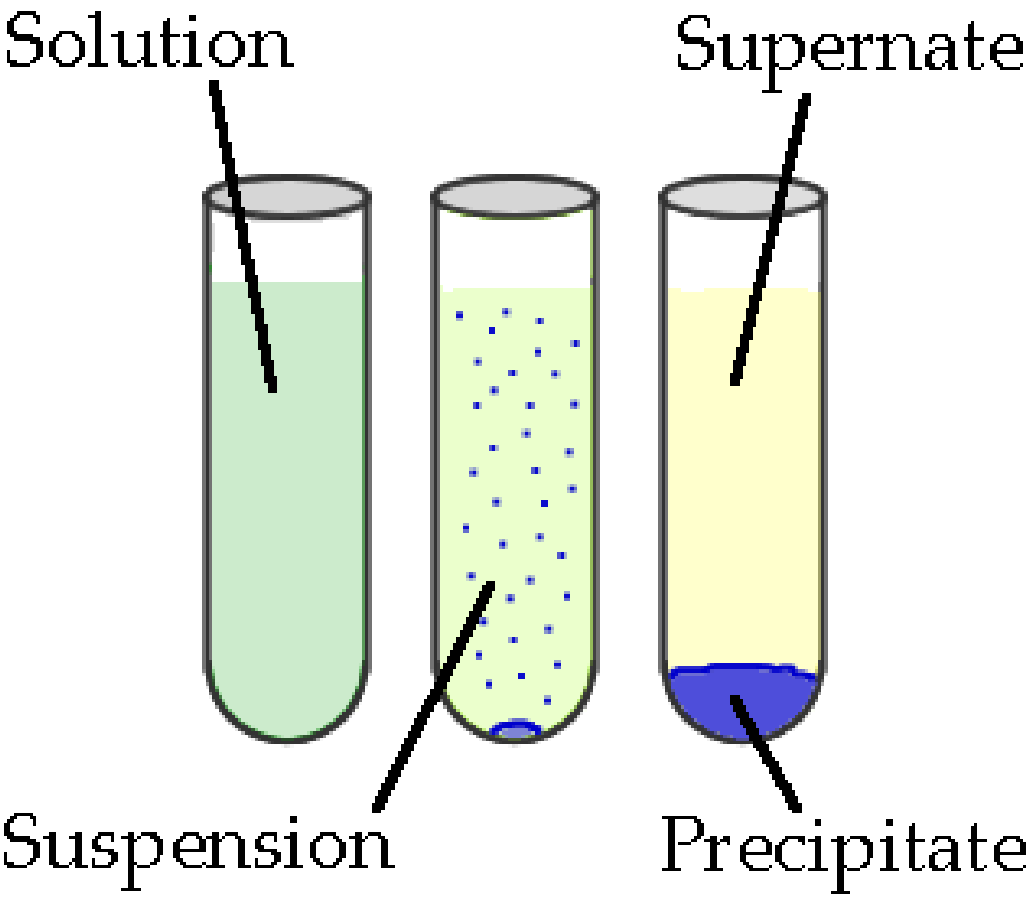
Heterogeneous mixtures

Suspensions	Colloids	Emulsions
Solute does not fully dissolve in solvent	Solution <Solute particle size< Suspension	Liquid + liquid
Solute particles are clearly visible	Solute particles do not settle out on standing	Will separate into immiscible liquids ONLY if no stabiliser added
Solute particles settle out upon standing	Solute particles can pass through filter paper	



Definition of solute, solvent and solutions





DECREASING SOLUBILITY

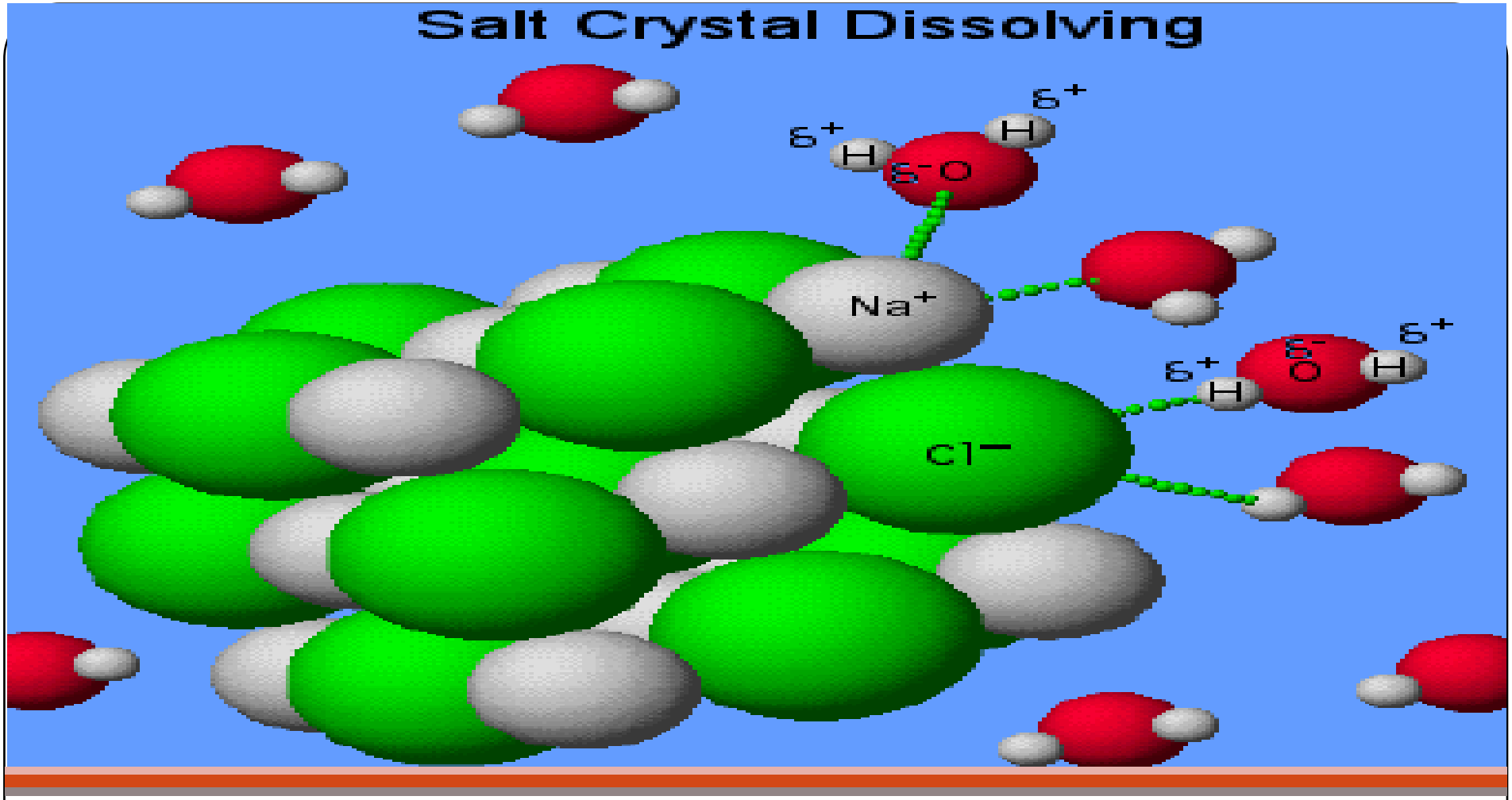


Table salt dissolving in water

Dissolving.

When a solute dissolves in a solvent, the particles of the solute fit in between the particles of the solvent.

There is no chemical reaction. The change is reversible and the essential components of the mixture remains the same.

Methods of Separation

❑Physical method

No new substance formed

No Change in chemical nature

Using physical properties

Vs

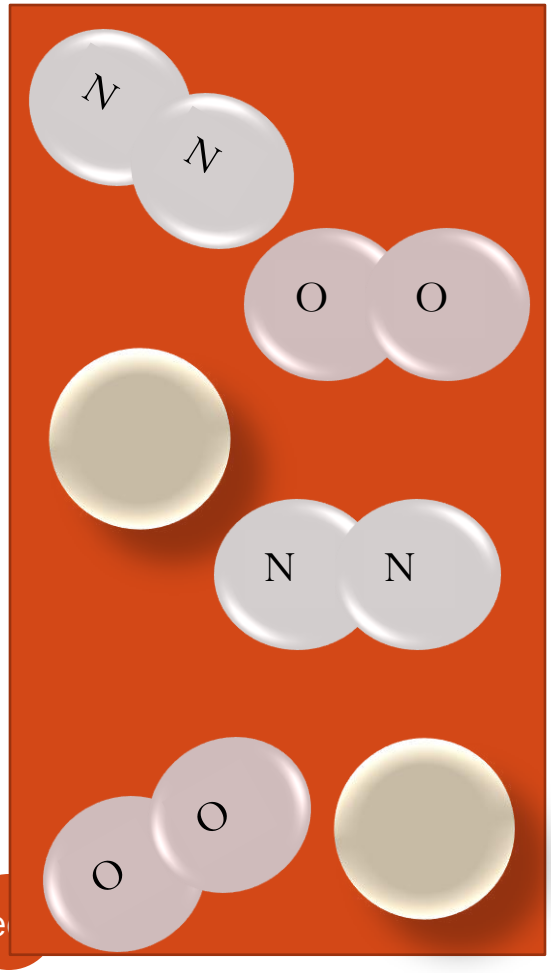
CHEMICAL METHOD

New substance(s) formed

Change in chemical nature

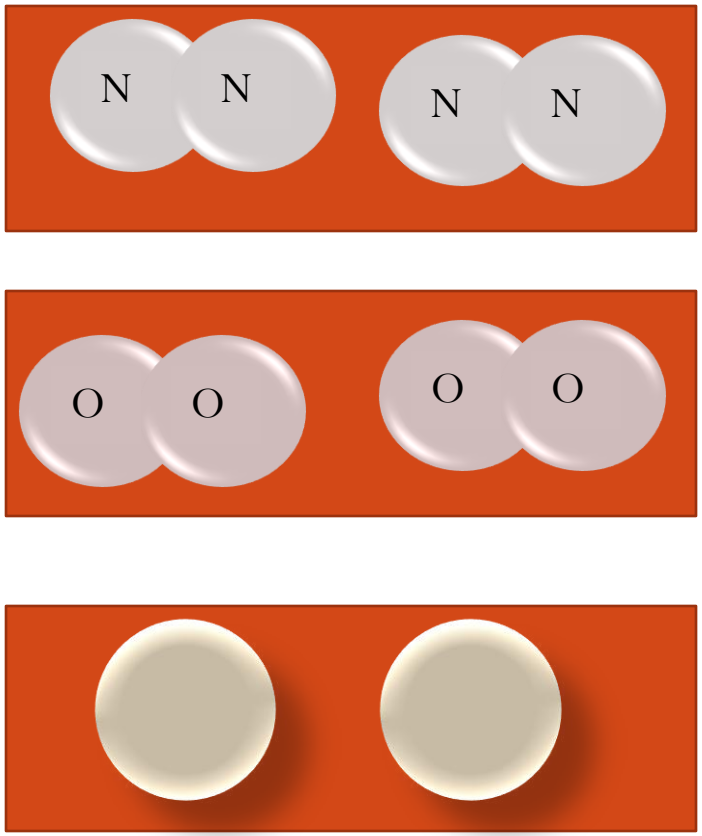
Using chemical properties

A mixture of different types of atoms and molecules



Can be separated by PHYSICAL MEANS into

Separate atoms and molecules



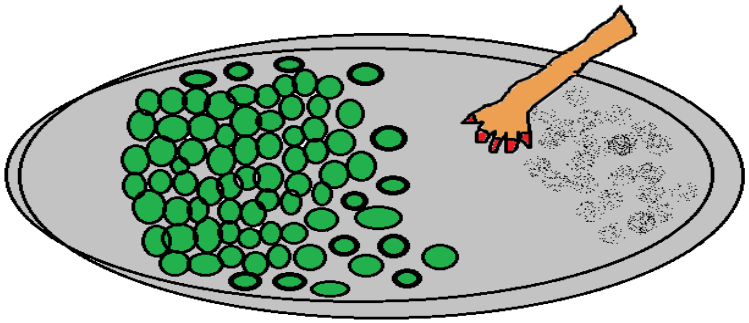
Types of separation techniques

Separation of mixtures

- Identify the different ways of separating mixtures.
- Determine how the different ways are used to separate mixtures.
- Identify the ways in which Hand Picking, Threshing, Winnowing, Sieving, Magnetic Attraction, Sublimation, Evaporation, Crystallization, Sedimentation & Decantation, Loading, Filtration, Distillation, Centrifugation, and Paper Chromatography can be used in daily life.

- Different ways of separating mixtures:
  - Hand Picking
  - Threshing
  - Winnowing
  - Sieving
  - Magnetic Attraction
  - Sublimation
  - Evaporation
  - Crystallization
  - Sedimentation & Decantation
  - Loading
  - Filtration
  - Distillation
  - Centrifugation
  - Paper Chromatography

Hand Picking



Hand Picking

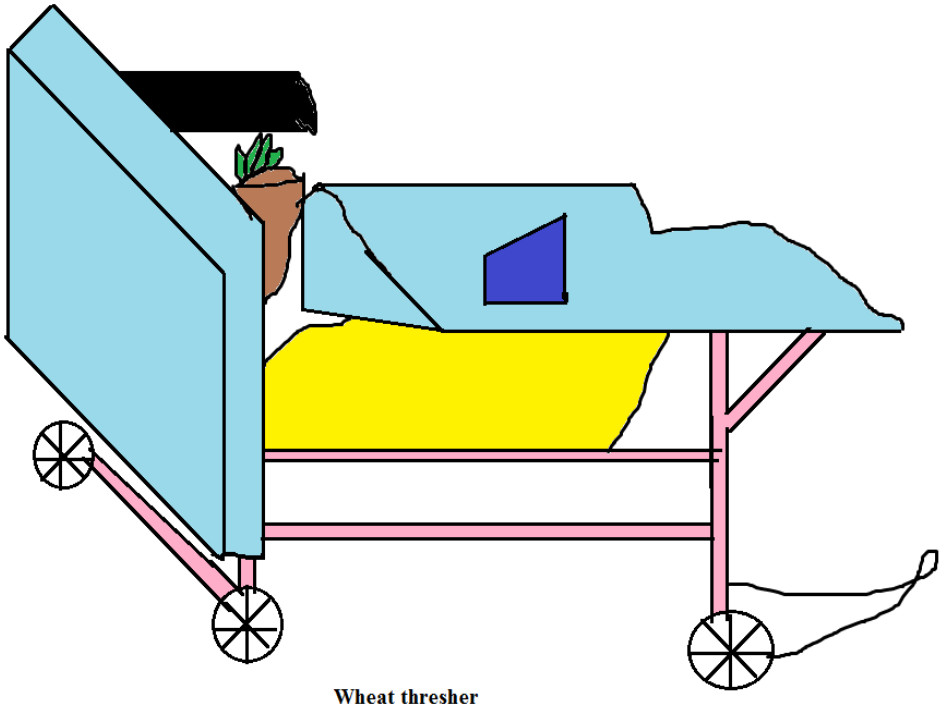
- The components of a solid-solid mixture can be separated by **hand picking**.

- This is only useful when the particles are large enough to be seen clearly.

For example
separating pebbles from rice or dal,
separating grass from mint leaves, and
separating parts of a salad

Threshing

- **Threshing** is the method that generally used by the farmers to separate the grains from the stalks after harvesting.
- The dried stalks are beaten or threshed to separate the grains.
- However, in large farms threshing is done by using threshing machines



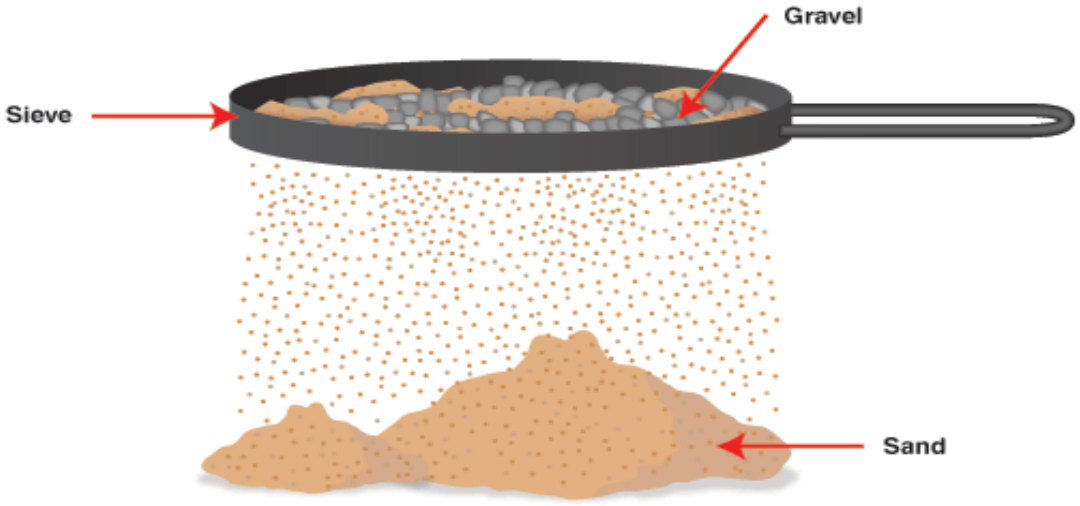
Wheat thresher

Winnowing

- In **Winnowing** the mixture is allowed to fall from a height.
- The lighten components get separated from the heavier ones because of wind or air blow.
- This method is used to separate lighter husk from heavier Grains like wheat.

Sieving

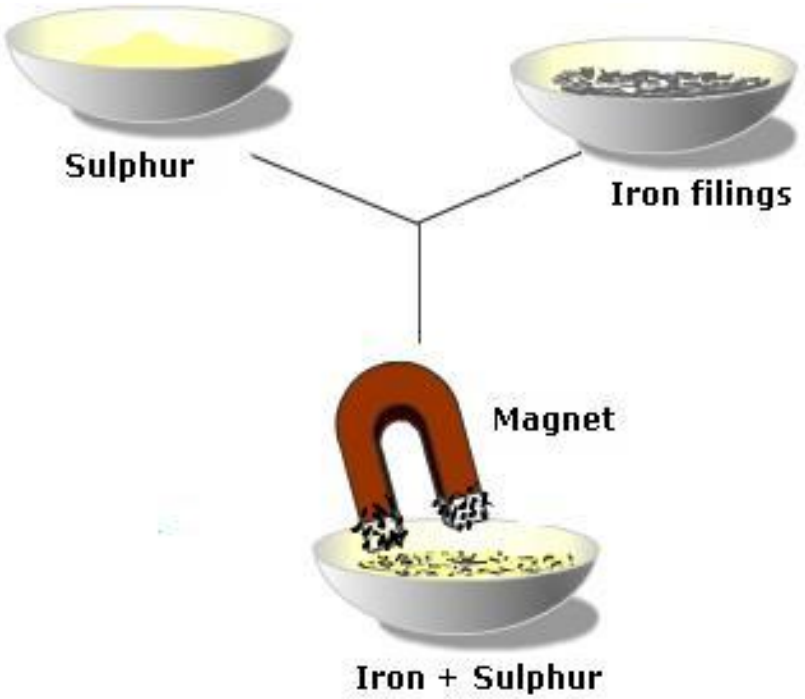
- **Sieving** is used to separate a dry mixture which contains substances of different sizes by passing it through a sieve.

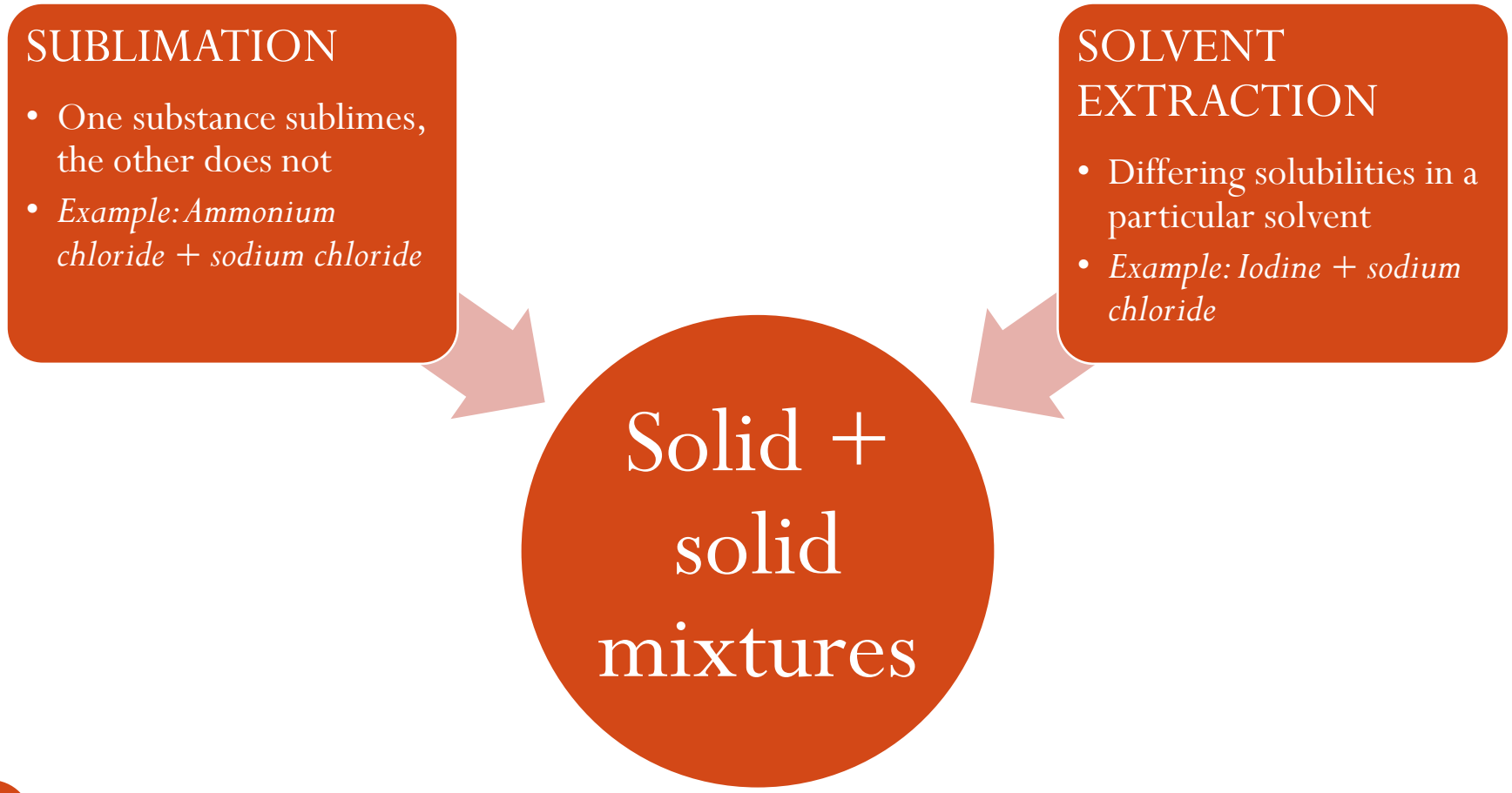


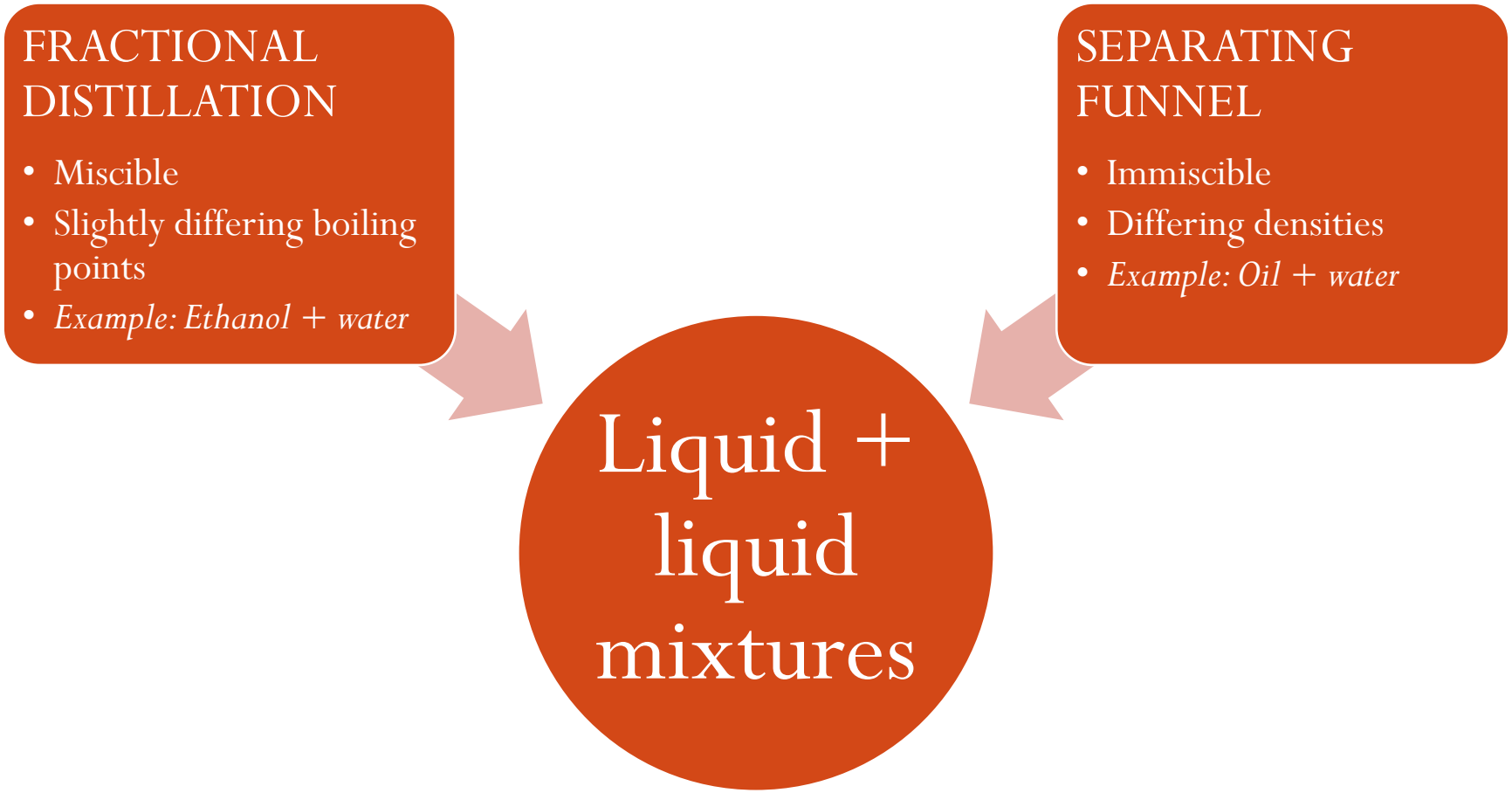
- A **sieve** is a device containing tiny holes and separates wanted elements from unwanted material.

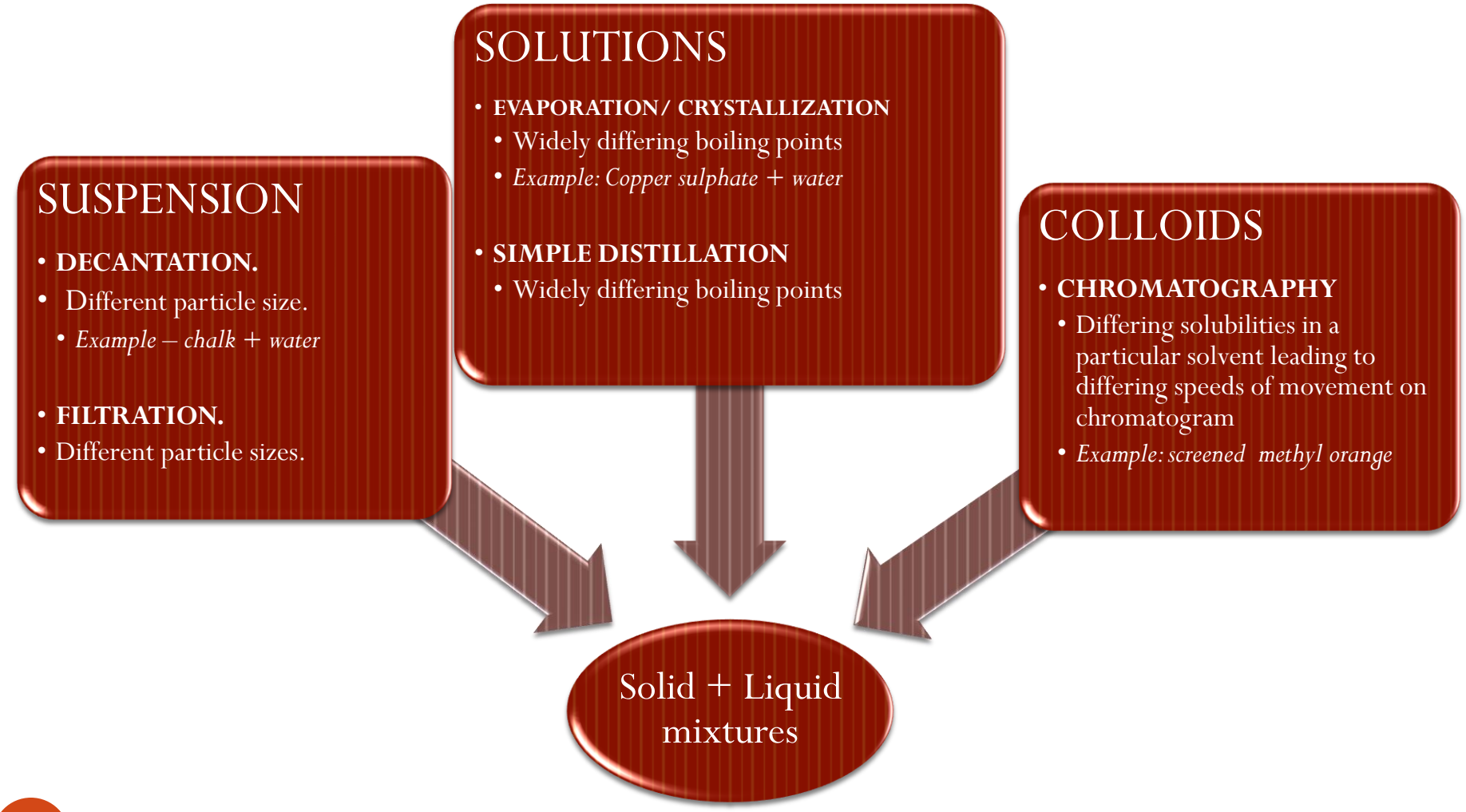
Magnetic separation

- **Magnetism** is a process in which magnetically susceptible material is extracted from a mixture using a magnetic force.



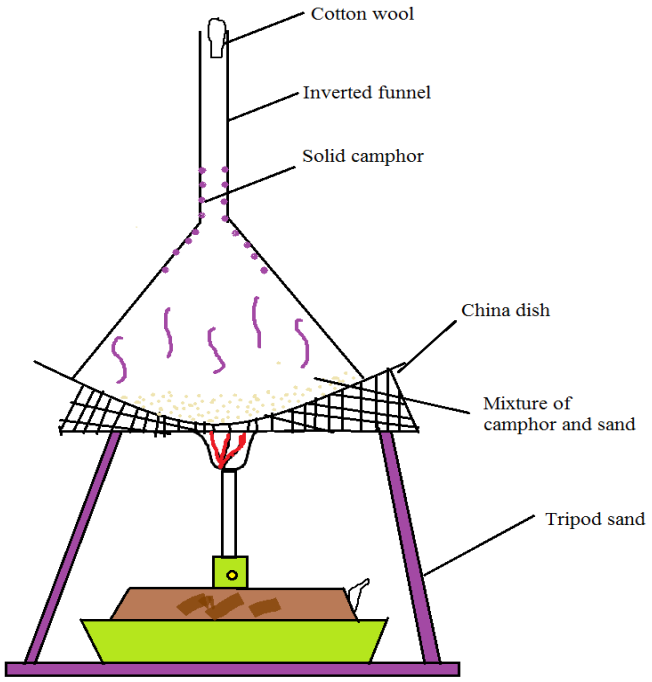

SUBLIMATION
• One substance sublimes, the other does not
• *Example: Ammonium chloride + sodium chloride*
SOLVENT EXTRACTION
• Differing solubilities in a particular solvent
• *Example: Iodine + sodium chloride*
Solid + solid mixtures


FRACTIONAL DISTILLATION
• Miscible
• Slightly differing boiling points
• *Example: Ethanol + water*
SEPARATING FUNNEL
• Immiscible
• Differing densities
• *Example: Oil + water*
Liquid + liquid mixtures


SOLUTIONS
• EVAPORATION/ CRYSTALLIZATION
• Widely differing boiling points
• Example: Copper sulphate + water
• SIMPLE DISTILLATION
• Widely differing boiling points
SUSPENSION
• DECANTATION.
• Different particle size.
• Example – chalk + water
• FILTRATION.
• Different particle sizes.
COLLOIDS
• CHROMATOGRAPHY
• Differing solubilities in a particular solvent leading to differing speeds of movement on chromatogram
• Example: screened methyl orange
Solid + Liquid mixtures

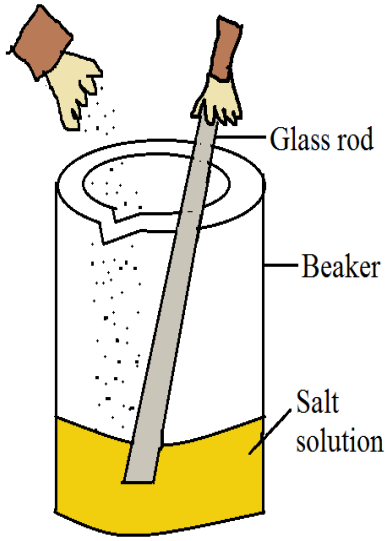
Sublimation

- The process in which a solid changes directly into gaseous state on heating is called **sublimation**.

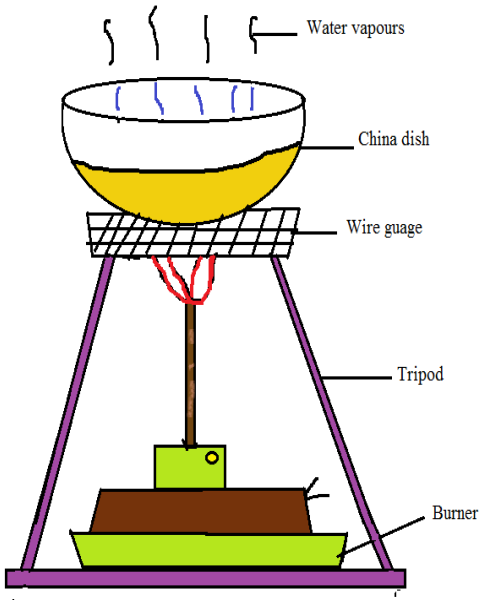


Sublimation

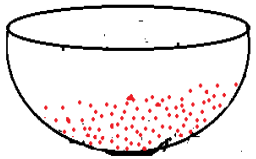
- **Evaporation** is a process in which a liquid changes into gaseous form on heating. Allowing the liquid to evaporate, leaving the soluble solid behind.



Mixture of salt and water

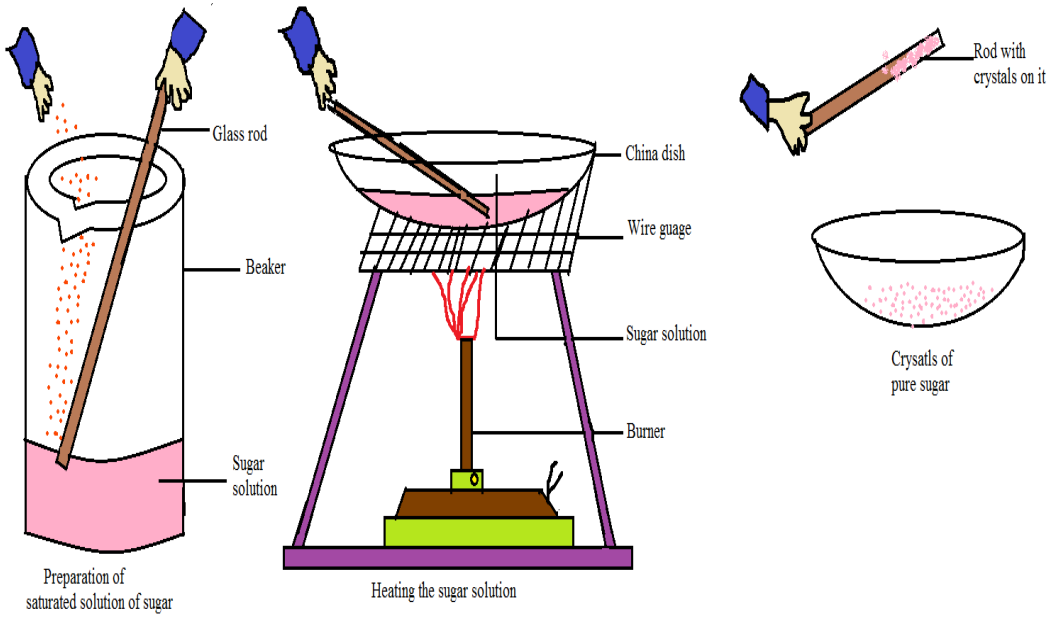


Evaporation


Pure common salt

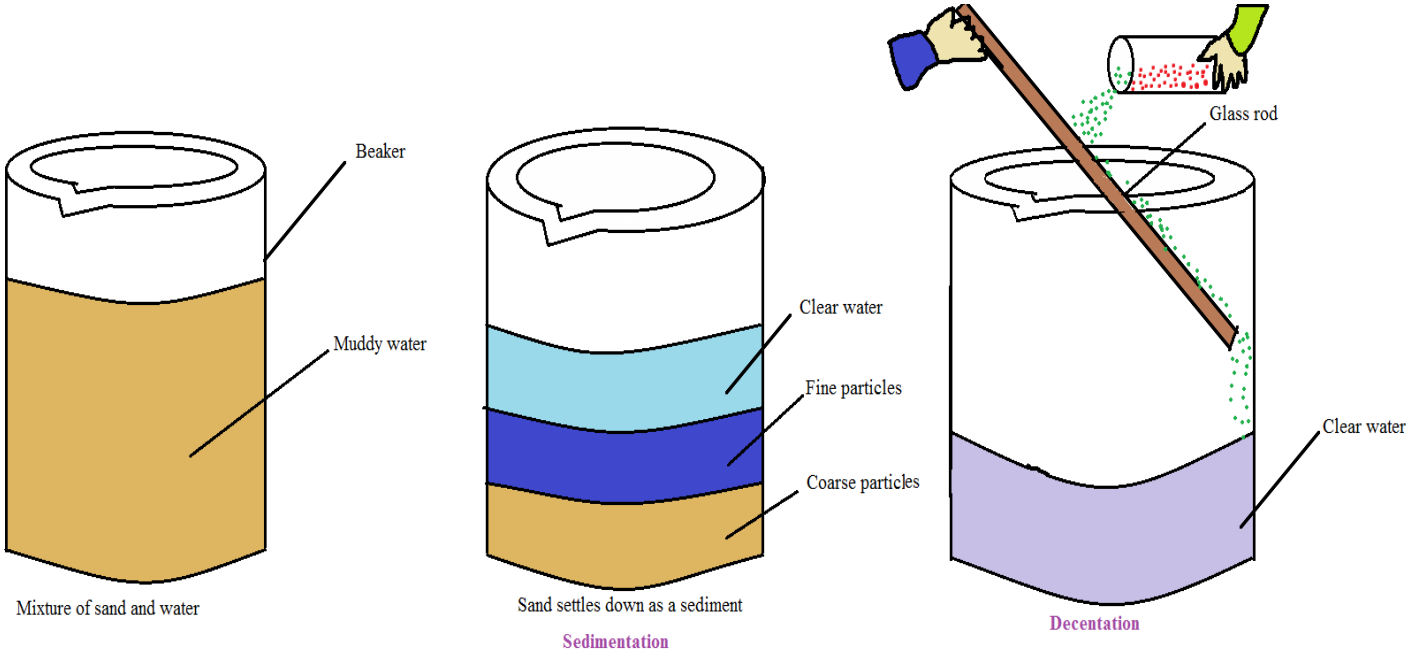
Crystallization

- **Crystallization** is a process which separates a pure solid in the form of its crystals from a saturated solution.



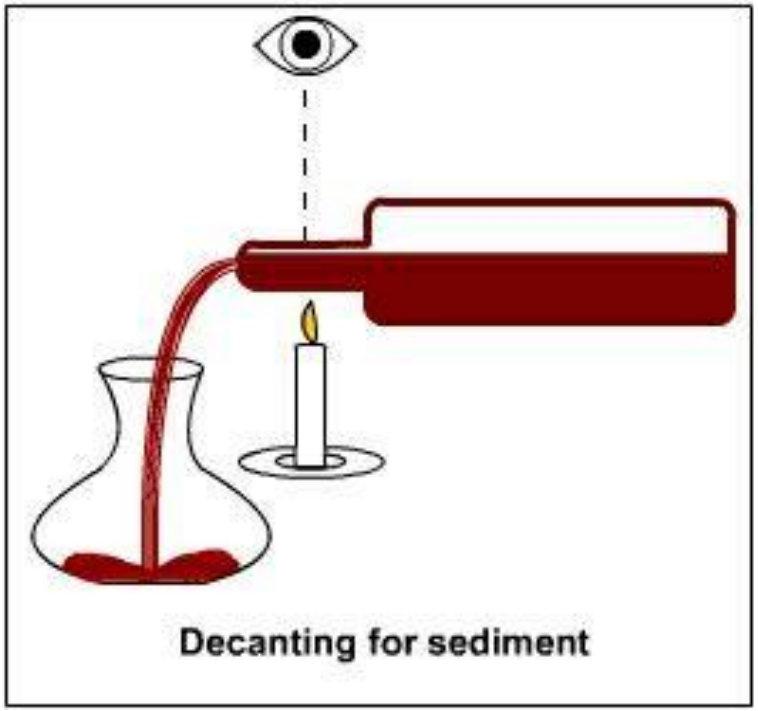
Sedimentation and Decantation

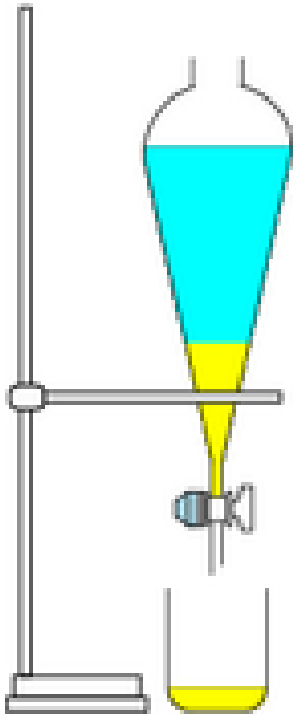
- **Sedimentation** is the process by which the insoluble, heavy solid particles settle down their own in a solution. In order to separate the two, the liquid has to be gently poured into another container without disturbing the sediments.



Decantation

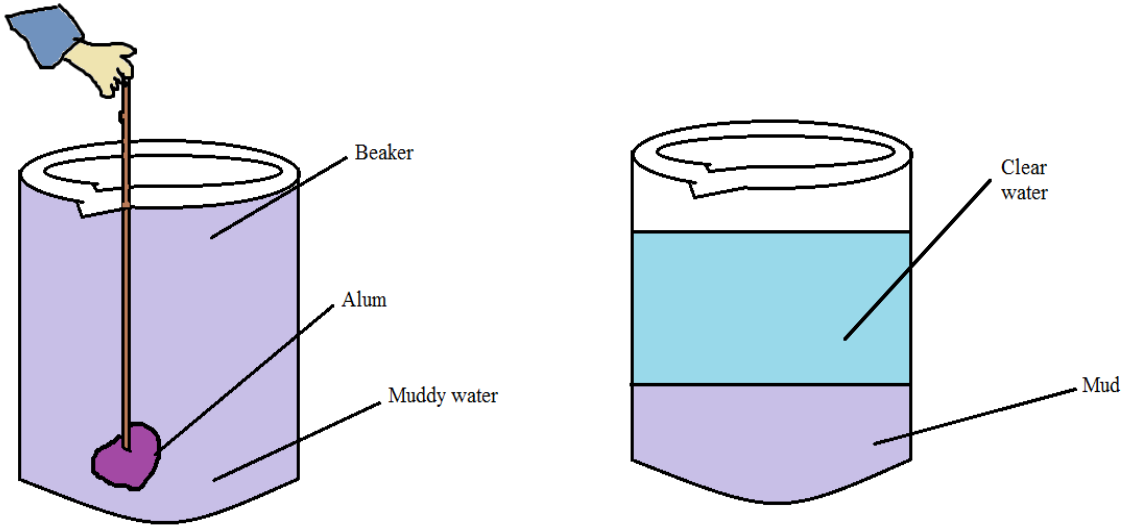
- This process of obtaining clear liquid by pouring a solution from a container in order to leave the sediments in the bottom of the original container is called **decantation.**





Loading

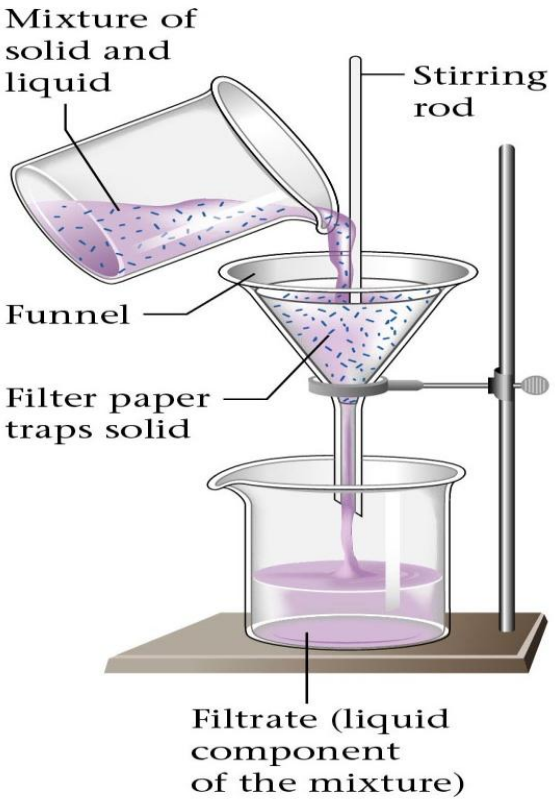
- **Loading** is a process which speeds up the sedimentation. In fact, loading is a faster process as compared to sedimentation.



Loading

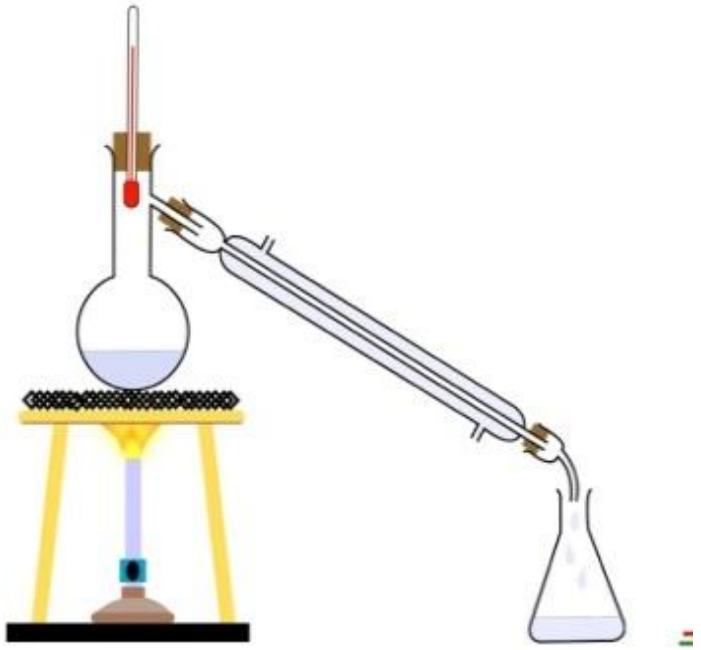
Filtration

- **Filtration** is commonly the mechanical or physical operation which is used for the separation of solids from fluids (liquids or gases) by interposing a medium through which only the fluid can pass.



Distillation

- **Distillation** **is** the process by which a mixture is separated by heating a solution and condensing using a cooling tube.
- The liquid collected is the **distillate**. Example: Gasoline, kerosene, fuel oil, and lubricating oil are produced from petroleum by distillation.



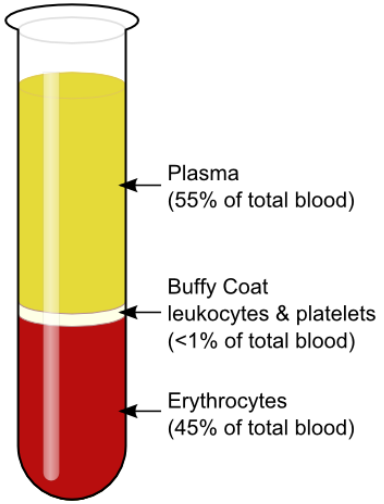
Centrifugation

- Spin sample very rapidly: denser materials go to bottom (outside)
- Separate blood into serum and plasma

-Plasma = less dense

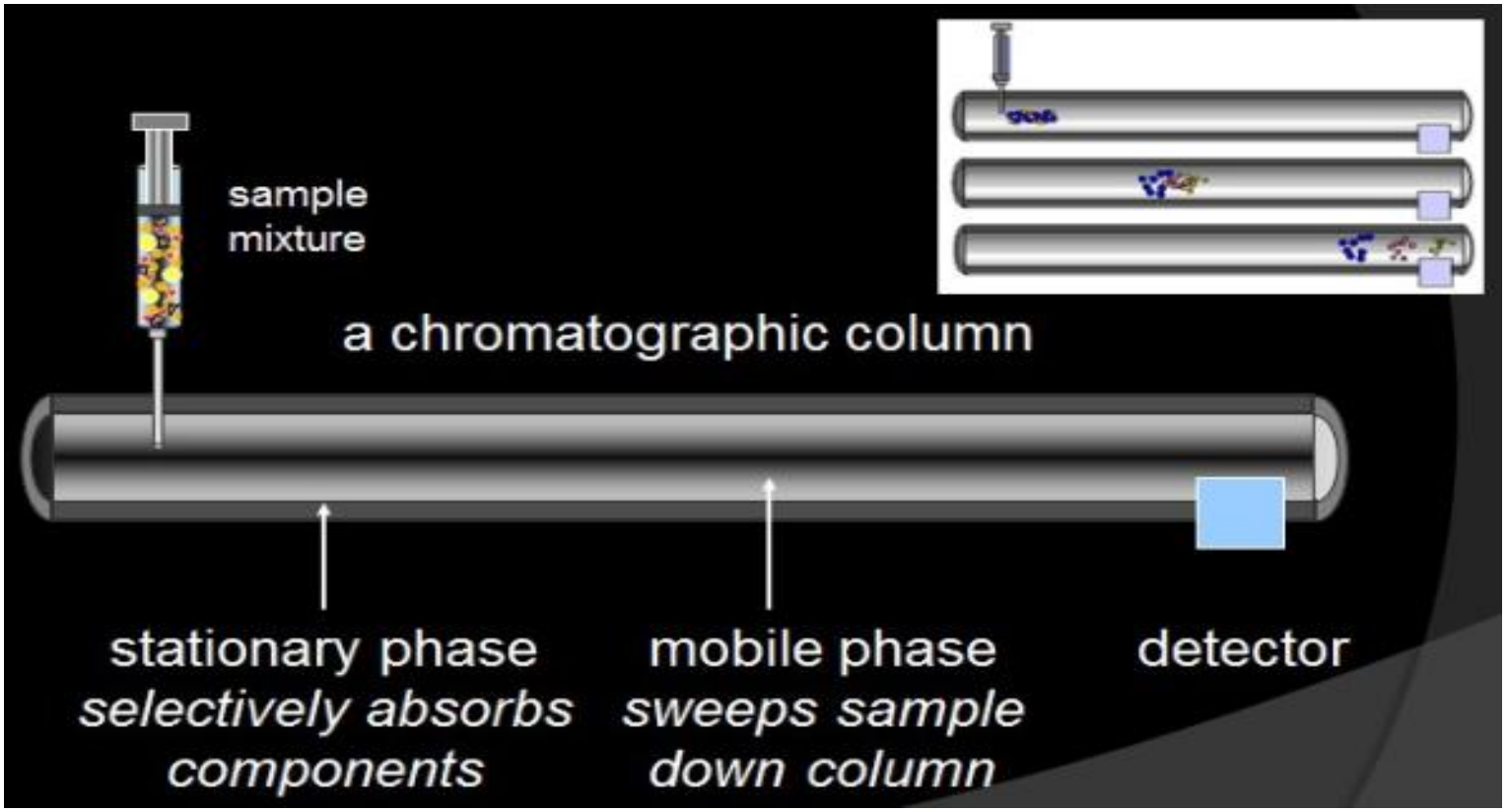
-Erythrocytes = red blood cells

-Check for anemia (lack of iron)



Paper Chromatography

- **Paper Chromatography** used to separate out one color from a mixture of colors.
- Separation by chromatography:



At a glance : Separation Method

Separation Method	What it separates
Chromatography	Compounds in a solution with same properties
Filtration	Solids or group of solids and liquids in a mixture
Evaporation	Solids that cannot decompose when heated in a solution
Crystallisation	Dissolved solids in a solution
Sublimation	Substances that sublime from two substances
Magnetic Attraction	Magnetic substances from non-magnetic ones
Fractional Distillation	Mixture of miscible (dissolved) liquids
Separating Funnel	Immiscible (un dissolved) liquids

- Uses of Technique in daily life

Separation Method	Common uses
Chromatography	▪Identify if foods contain banned dyes ▪ Identify coloured substances used food products
Filtration	• Separating sand from water • Human nose traps dust and allows oxygen to pass
Simple Distillation	• Separating water from salt water in desalination
Crystallisation	• Separating salt from salt water
Sublimation	• Separate iodine from sand
Magnetic Attraction	• Recycling magnetic materials by separating them from domestic waste
Fractional Distillation	• Separate petrol, kerosene and diesel from petroleum • Obtain nitrogen, argon and oxygen from air
Separating Funnel	• Separate oil and water