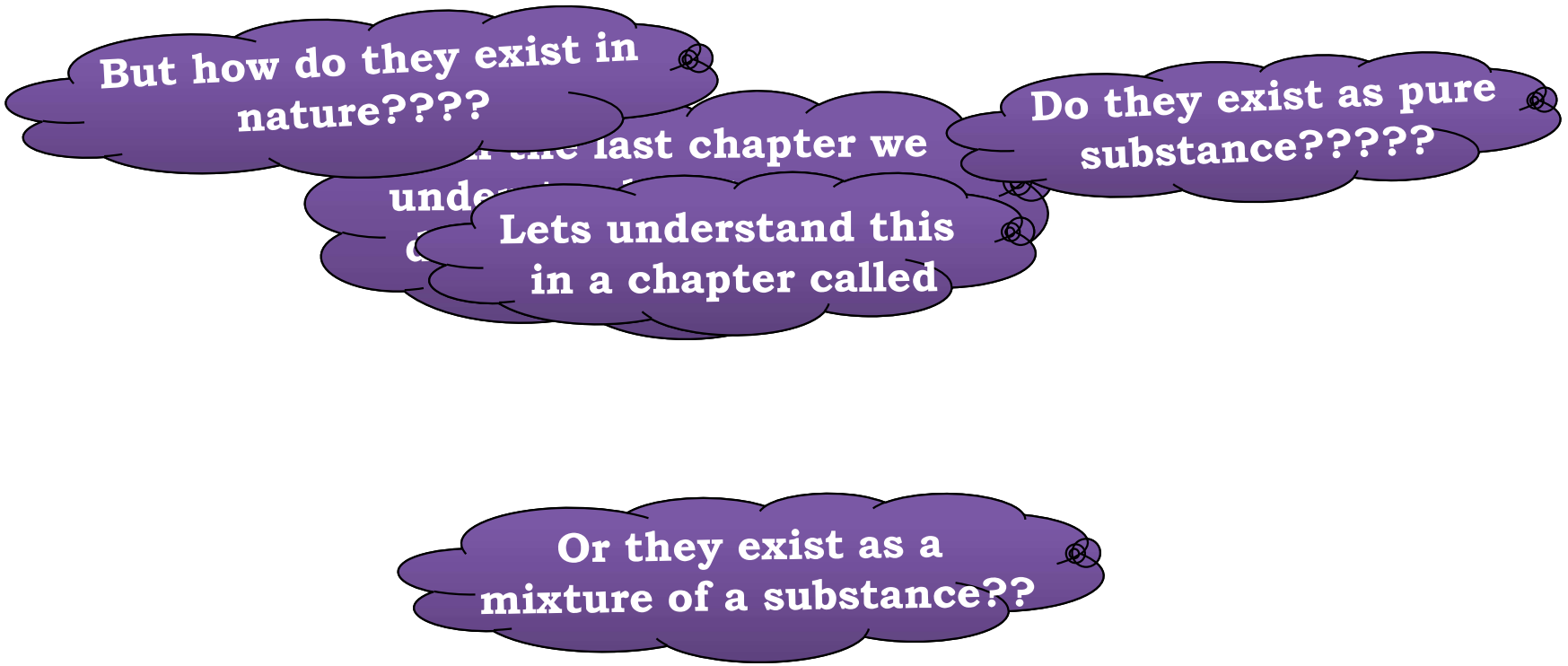
IS MATTER AROUND US PURE

MODULE : 1

- **Matter and its classification**


But how do they exist in nature????
Do they exist as pure substance?????
Lets understand this in a chapter called
Or they exist as a mixture of a substance??

IS MATTER AROUND US PURE

MATTER is m **MATTER** rticles.

Pure

Impure

Eg. Sugar, common salt

In this way a substance

Eg. Soil, milk

o matter is classified as

ke soil, milk co

broken rocks, s

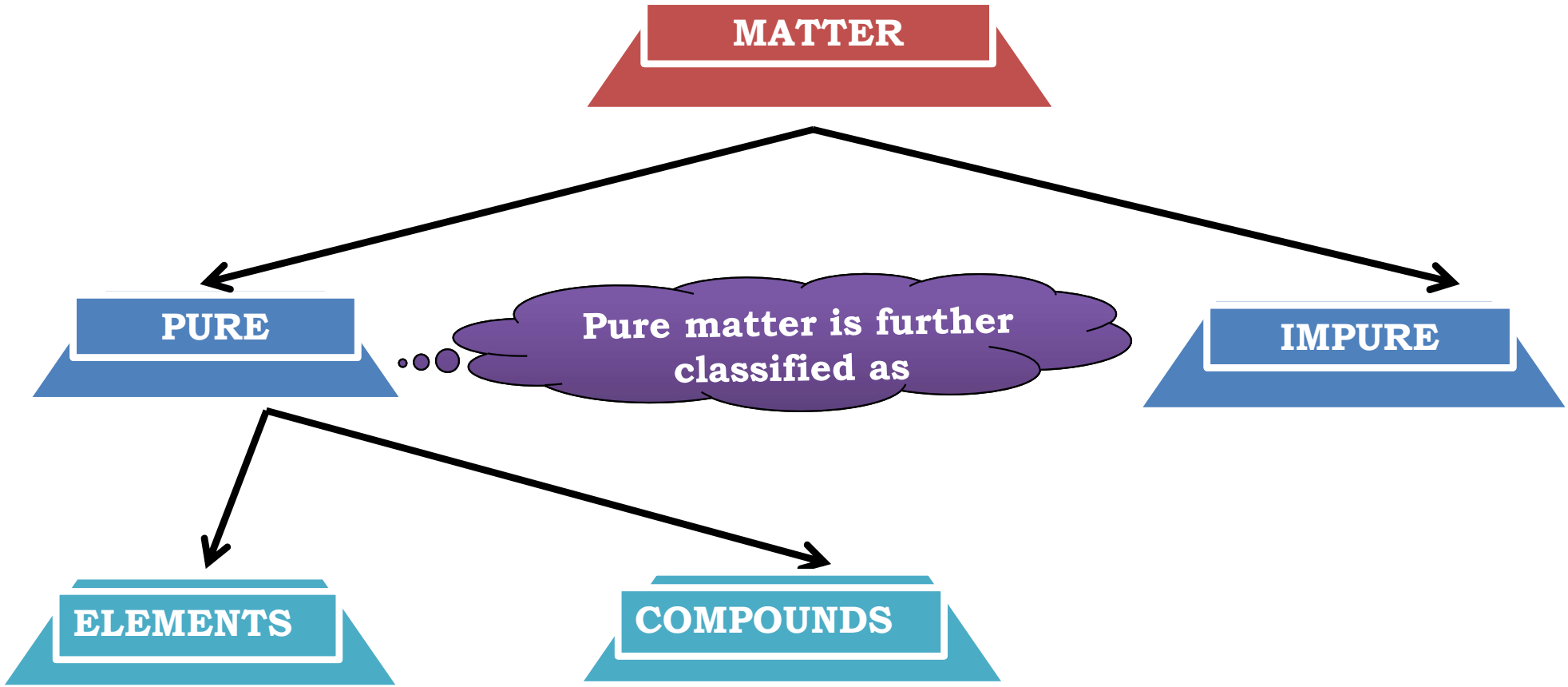
such matter

ces .....

c..

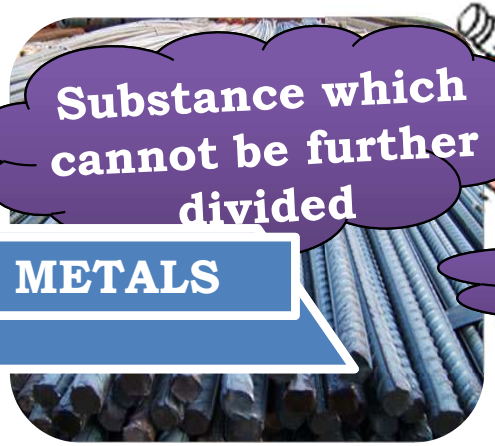
Contains only one type of substance

Contains more than one type of substance


MATTER
PURE
Pure matter is further classified as
IMPURE
ELEMENTS
COMPOUNDS

EJ

ELEMENTS



Substance which cannot be further divided

On hammering iron rods you will get all iron element is n... ments

Elements are further classified as

Let us

METALS

NON-METALS

METALLOIDS

Atom

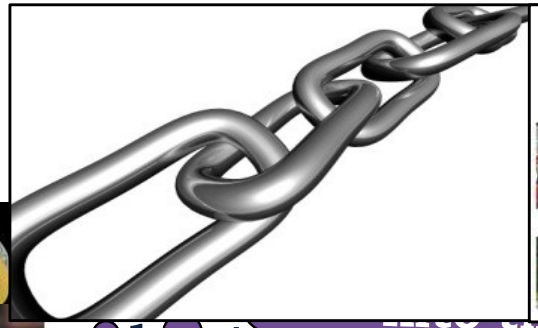
An element is a type of matter composed of only one kind of substance where each smallest indivisible part of it has the same properties.

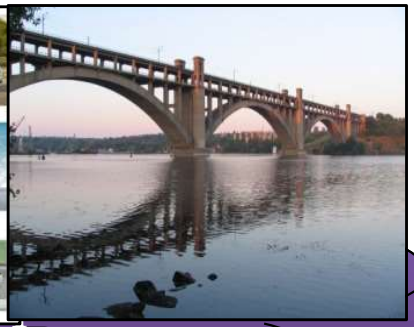
MODULE : 2

- **Classification of elements . Properties of metals and non metals**

Metals

- Lustrous
- Sonorous
- Ductile





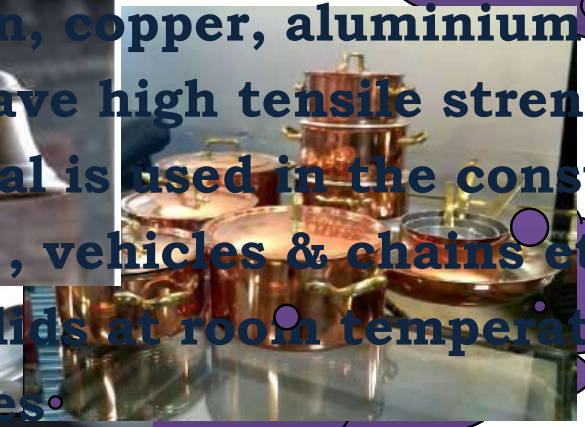
or heat

with a ha

Exception sodium and potassium metals have low densities.

- Hard e.g. iron, copper, aluminium
- Strong and have high tensile strengt

e.g. Iron metal is used in the construction of bridges, railway lines , vehicles & chains etc



- Generally solids at room temperature
- High densities

NON METALS

- Exception Iodine has l
- rength
- solid, liquid or gase
- and boiling points
- electricity

Bromine is the only non-metal in liquid state

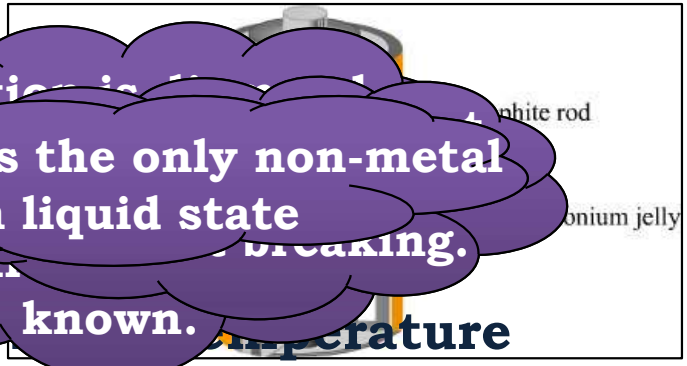
Non-metals ca
be beaten into thi
heets.

known.

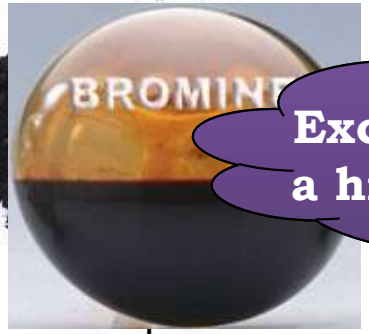
breaking.

Exception is graphite which has a high melting point i.e. 3700°C

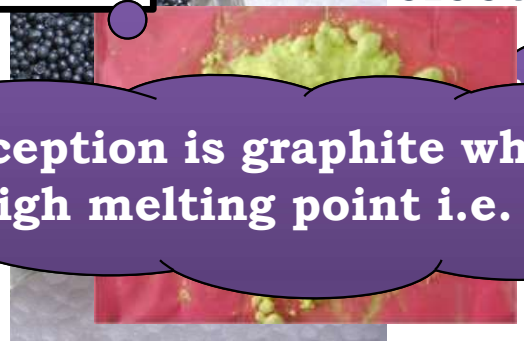
Diamond



Dry cell



Bromine



Sulphur

Chlorine

Metals	Non-Metals
Malleable & Ductile	Neither malleable nor ductile. Non-metals are brittle
Good conductors of heat and electricity	Bad conductor of heat and electricity
Lustrous	Non lustrous
Generally solids at room temperature	May be solid, liquid or gases at room temperature
High tensile strength	Low tensile strength
Sonorous	Non-Sonorous

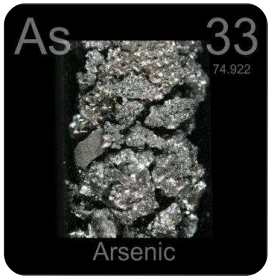
MODULE : 3

- **Metalloids, compounds and their properties**

METALLOIDS :-

Metalloids have common characteristics to metals and Non-Metals.

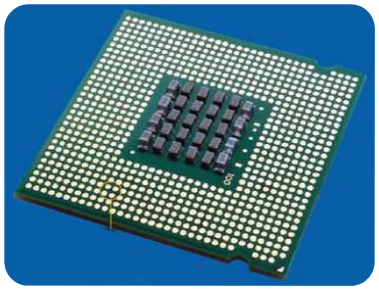
E.gs.- Arsenic, Silicon, Germanium, Etc.....



Arsenic

Silicon

Germanium



Silicon

- **Good conductor like metals.**
- **Has low melting point like nonmetals.**

Used as semiconductors (for making electronic Chips)

COMPOUNDS

H_2O

Water

NaCl

Salt

$CuSO_4$

Copper sulphate

A c is the subs de up of tw elements chemically combined in a fixed pr and it can be further subdivided into simpler substances only by chemical means.

Elements of compounds are bonded with imaginary Forces of attraction.

No. of atoms of an element in a compound are always fixed.

ome

ns

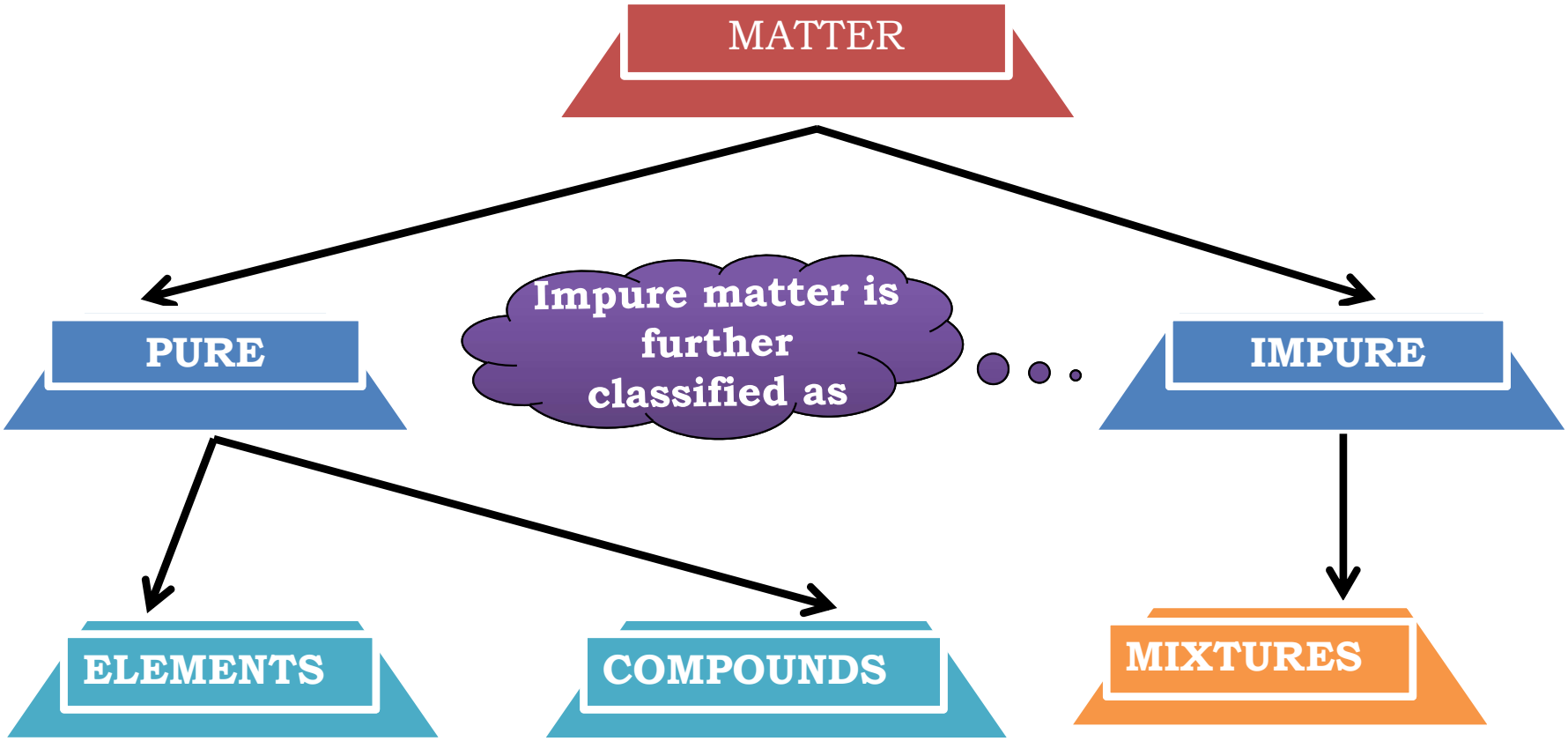
PROPERTIES OF COMPOUNDS

1. **Compound can be further subdivided into simpler substances only by chemical means.**

2. **Compound can be represented by using molecular formula. e.g.- H_2O**

3. **Compound has totally new properties than the constituents.**
   e.g. Water (H_2O)

H_2 gas is combustible (Catches fire) and O_2 supports combustion but water extinguishes fire.


MATTER
PURE
Impure matter is further classified as
IMPURE
ELEMENTS
COMPOUNDS
MIXTURES

IMPURE MATTER

Which is further divided

No.....

So this kind of substance is

Known as

MIXTURE

All ingredients are mixed in any proportion

A mixture is a substance which is obtained by mixing two or more substances in any proportion.

MODULE : 4

- **Properties and types of mixtures**

PROPERTIES OF MIXTURE

The mixture can be further subdivided into simpler substances by simple physical pro , hand picking etc..

MIXTURES

The constituents of a mixture retain their original properties.

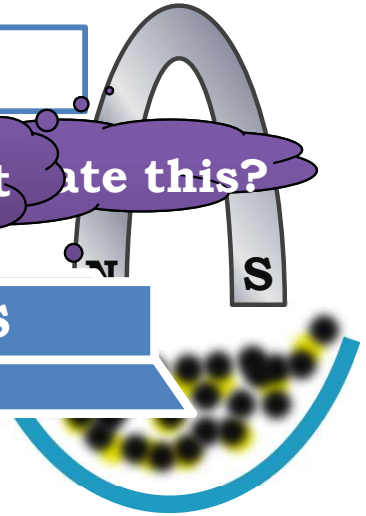
In a mixture the consti ixed prop

Mixtures are further classified as

Ca Magnet te this?

HOMOGENOUS

HETEROGENOUS



&

Iron

CLASSIFICATION OF MIXTURES

HOMOGENOUS MIXTURE

A homogenous mixture is a mixture in which constituents are uniformly mixed throughout the mixture.

- Uniform composition
- Not physically distinguishable

Water + Sugar + Lemon syrup

Sherbet

HETEROGENOUS MIXTURE

A heterogeneous mixture is a mixture in which the constituents are not uniformly mixed throughout the mixture.

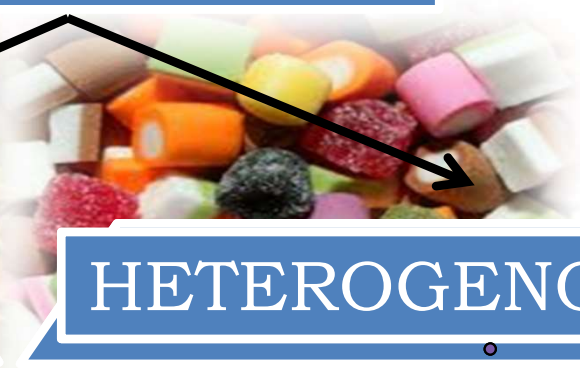
- Non-uniform composition
- Physically distinguishable

Muddy water

Water and Oil

MIXTURES

HOMOGENOUS



HETEROGENOUS

SOLUTIONS

Heterogeneous mixtures are further classified as

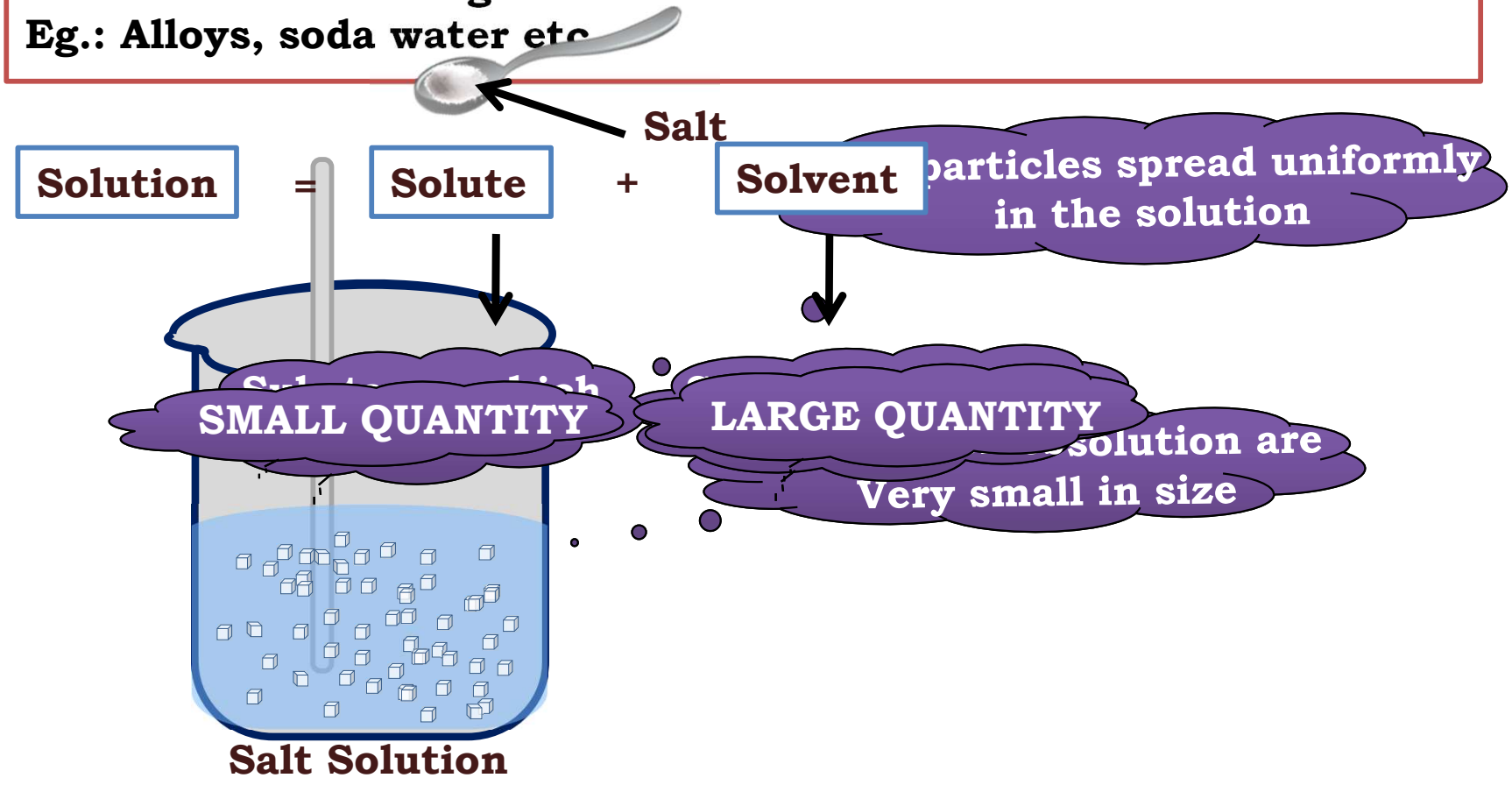
OLLOIDS

MODULE : 5

- **Homogeneous mixture (solution)**

SOLUTION

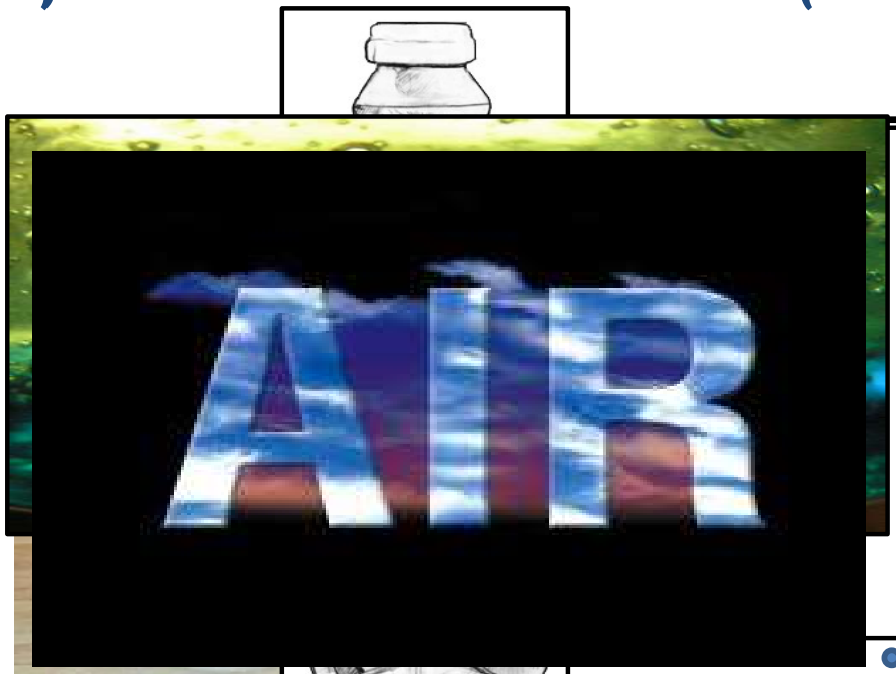
A solution is a homogenous mixture of two or more substances.
Eg.: Alloys, soda water etc



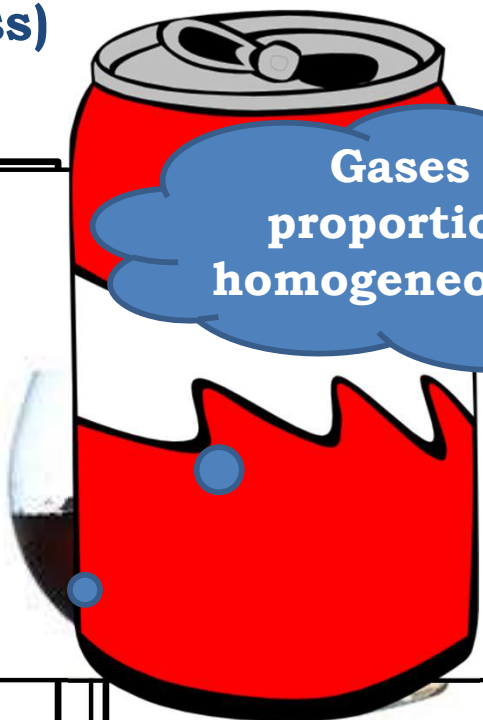
TYPES OF SOLUTION

2) Solution of Gas in Liquid :

3) Solution of Solid in Solid : (Brass)



Gases in any proportion form a homogeneous mixture



Carbon dioxide in aerated drink

Vinegar

Acetic acid+Water

Salt solution

Salt+Water

Alcohol+Water

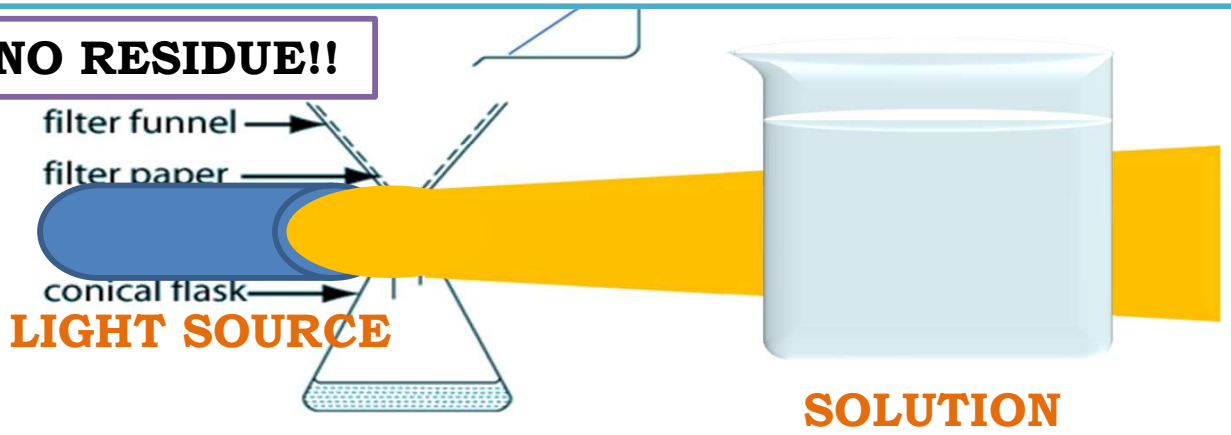
Tincture Iodine

Iodine+Alcohol

PROPERTIES OF SOLUTION

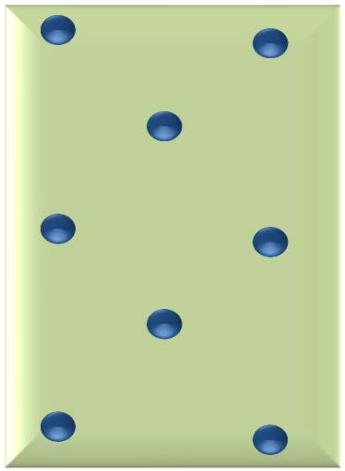
- ❖Particle Size : 1nm
- ❖Physically undistinguishable, Stable solution
- ❖Homogeneous mixture.
- ❖ Particles are evenly distributed. True solution
- ❖ Cannot be separated by filtration process
- ❖ Do not scatter the beam of light, Light path is not visible

NO RESIDUE!!



Concentration of a Solution

Depending upon the amount of solute in solution



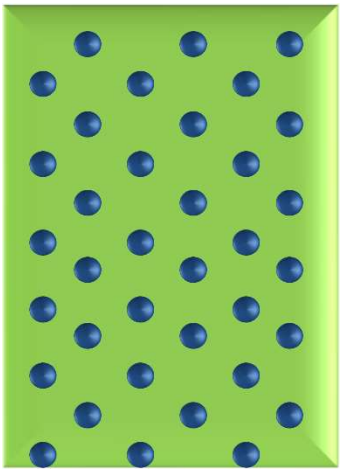
Solution

DILUTE

Solution with lesser amount of solute

CONCENTRATED

Solution with higher amount of solute



MODULE : 6

- **Concentration and Numericals**

MEASURING CONCENTRATION

✓ **MASS BY MASS PERCENTAGE**

$$\frac{\text{Mass of } \textbf{solute}}{\text{Mass of } \textbf{solution}} \times 100$$

Mass of solution = mass of solute + mass of solvent

✓ **MASS BY VOLUME PERCENTAGE**

$$\frac{\text{Mass of } \textbf{solute}}{\text{Volume of } \textbf{solution}} \times 100$$

Numerical

A solution contains 40g of common salt in 320g of water. Calculate the concentration in terms of mass percentage of solution.

Mass of solute (salt) = 40g

Mass of solvent (water) = 320g

Mass of solution = mass of solute + mass of solvent
= (40 + 320) g = 360g

Mass percentage of solution =

$$\frac{\text{Mass of } \textbf{solute}}{\text{Mass of } \textbf{solution}} \times 100$$

$$= \frac{40}{360} \times 100 = 11.1\%$$

Numerical

A solution contains 30g of sugar dissolved in 370g of water. Calculate the concentration of this solution.

Mass of solute (sugar) =30 g

Mass of solvent (water) = 370 g

Mass of solution = mass of solute + mass of solvent

= (30 + 370) g = 400g

Mass percentage of solution =

$$\frac{\text{Mass of } \textbf{solute}}{\text{Mass of } \textbf{solution}} \times 100$$

$$= \frac{30}{400} \times 100 = \boxed{7.5\ \%}$$

Numerical

If 110g of sodium chloride is present in 550ml of solution, calculate the concentration of the solution.

Mass of solute (sodium chloride) = 110 g

Volume of solution = 550 mL

Volume percentage of solution =

$$\frac{\text{Mass of } \textbf{solute}}{\text{Volume of } \textbf{solution}} \times 100$$

$$= \frac{\mathbf{110}}{\mathbf{550}} \mathbf{\times 100} = \boxed{\mathbf{20\ \%}}$$

MODULE : 7

- **Solubility and factors affecting solubility**

Saturated and Unsaturated solution

ATION OF SOLUTION

- A solution in which more quantity of solute can be dissolved without raising its temperature, is called an unsaturated solution.

SOLUTION

UNSATUR

SATURAT

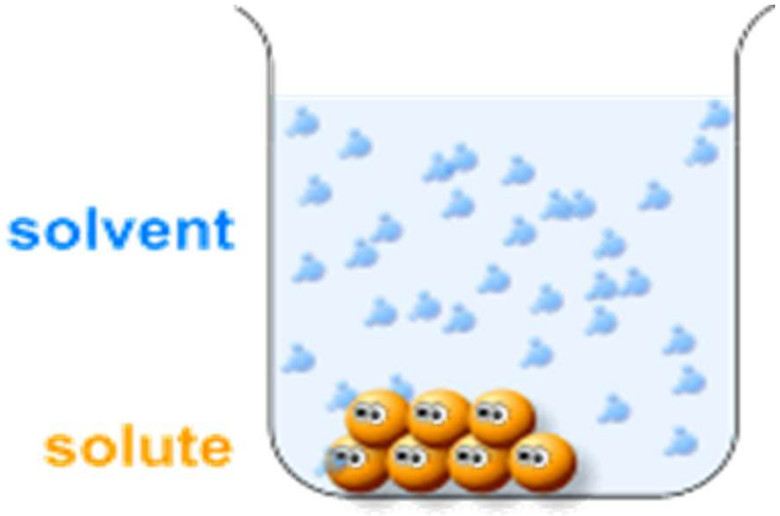
Unsaturated solution

Saturated solution

- A solution in which no more solute can be dissolved at the temperature, is called as saturated solution.

SOLUBILITY

Maximum amount of solute which can be dissolved in 100g of a solvent at a specific temperature.



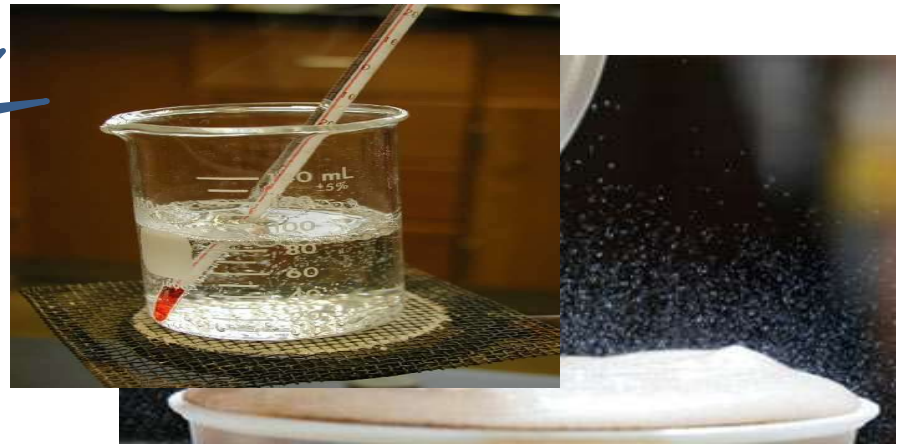
Effect of temperature and pressure on solubility

Gases in liquids

- Usually increases on increasing the temperature, decreases on decreasing the temperature
- Remains unaffected by the changes in pressure
- Increases on increasing the pressure; and decreases on decreasing the pressure

Water contains dissolved

Aerated drinks contain carbon dioxide gas dissolved in water under pressure. When bottle is opened pressure falls and gas escapes producing a fizz



Effe… …n a…

SATURATED SOLUTION

SATURATED SOLUTION

- If a s… …n at a particu… …s heated to a higher temp… …becomes unsa…
- If a saturated solution at a particular temperature is coole… temperatu… …hen some of its dissolved so… …e will separat… the form o… …lid crystal.

HEATING

COOLING

Solubility of solid solute increases on heating an… …more of a solute can be diss… …ed.

The properties is called as precipitation

UNSATURATED SOLUTION

PRECIPITATED

MODULE : 8

- **Numericals of solubility and suspension**

EXAMPLES :

Substance (Solute)	Solubility in water (at 20°C)
Copper Sulphate	21 g
Potassium Nitrate	32 g
Potassium Chloride	34 g
Sodium Chloride	36 g
Ammonium Chloride	37 g
Sugar	204g

A student determined the solubility of 4 substances

→ KNO_3

→ NaCl

→ KCl

→ NH_4Cl

In water at 5 different temperatures as follows:

Substance	10°C	20°C	40°C	60°C	80°C
Potassium Nitrate	21 g	32 g	62 g	106 g	167 g
Sodium Chloride	36 g	36 g	36 g	37 g	37 g
Potassium Chloride	35 g	35 g	40 g	46 g	54 g
Ammonium Chloride	24 g	37 g	41 g	55 g	66 g

Q). What mass of KNO_3 would be needed to make a saturated solution of KNO_3 in 50g of water at 40°C?

Solution :-

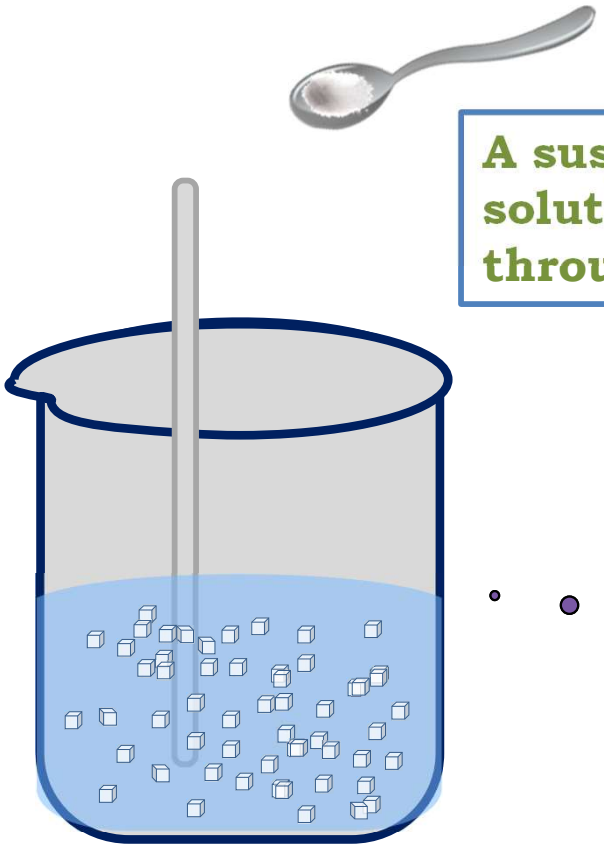
The solubility of KNO_3 at 40°C is 62gms this means that 62 gms of KNO_3 is needed to make a saturated solution of KNO_3 in 100 gms of water at 40°C.

to make a saturated solution in 50 gms of water we will require half of 62 gms of KNO_3

which is = 62/2

=31 gms.

SUSPENSIONS

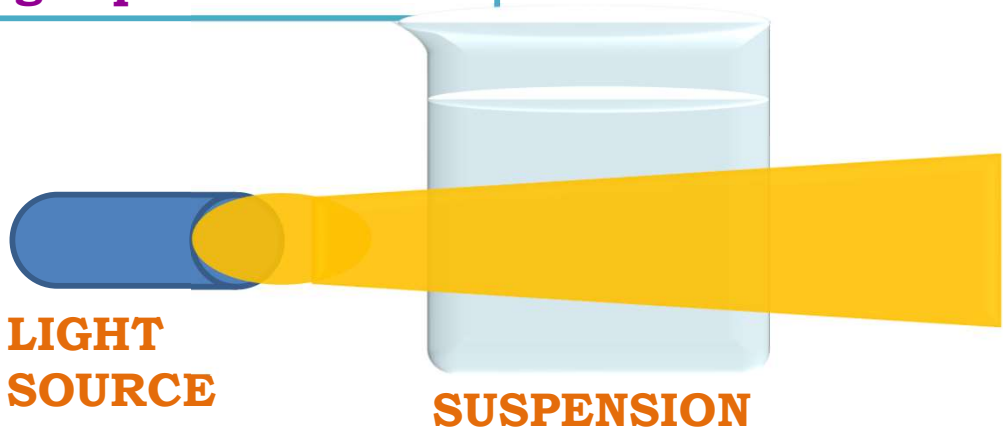


A suspension is a heterogeneous mixture in which the solute particles do not dissolve but remain suspended throughout the bulk of the medium.

These particles are visible to the naked eye.

PROPERTIES OF SUSPENSION

- ❖Particle Size : >100 nm: visible to naked eyes.
- ❖ Particles remain suspended
- ❖Heterogeneous mixture.
- ❖ Settle down when left undisturbed-unstable
- ❖ Can be separated by filtration process
- ❖ Scatter the beam of Light path is visible



MODULE : 9

- **Colloid , properties and types**

COLLOID

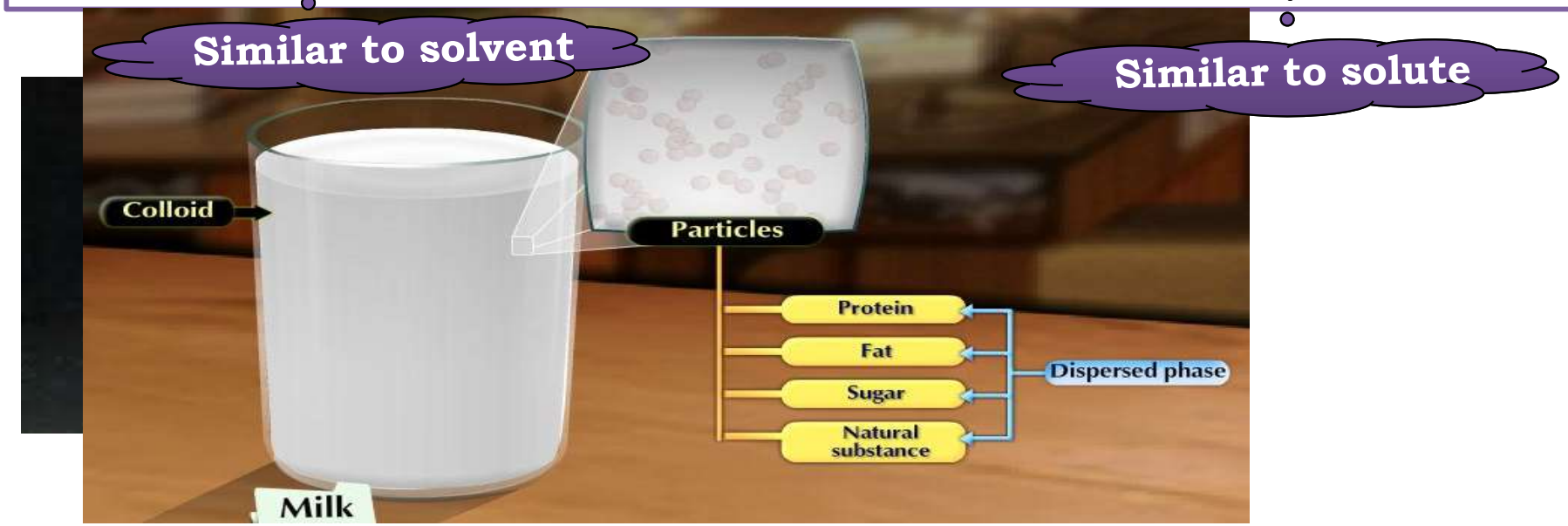
DISPERSION MEDIUM

DISPERSED PHASE

A col… …n in which the size… …es is intermediate between those in true solutions and those in suspension.

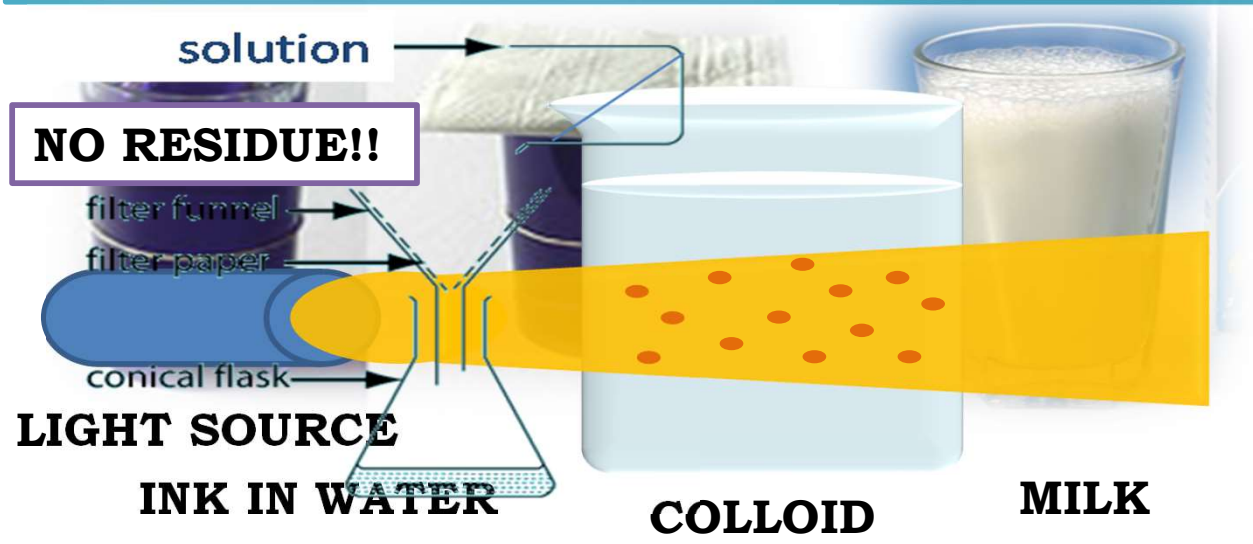
Similar to solvent

Similar to solute



PROPERTIES OF COLLOID

- ❖Particle Size : 1 nm - 100 nm
- ❖ Appears homogeneous, but hetrogeneous mixture
- ❖ Do not settle down when left undisturbed - stable
- ❖ Cannot be separated by filtration process
- ❖ Scatter the beam of light, light path is visible *"Tyndall Effect"*



Tyndall Effect

TYPES OF COLLOID

TYPE	DISPERSED PHASE	DISPERSED MEDIUM	EXAMPLES
GEL EMULSION AEROSOL FOAM SOL SOLID SOL	LIQUID LIQUID GAS SOLID	SOLID LIQUID LIQUID SOLID	FOG, CLOUDS, MIST BUTTER PUMICE, SPONGE COLOURED GEMSTONE, MILKY GLASS

COLOURED GEMSTONE

MILKY GLASS

AUTOMOBILE EXHAUST

TYPES OF COLLOID

TYPE	DISPERSED PHASE	DISPERSED MEDIUM	EXAMPLES
AEROSOL	LIQUID	GAS	FOG, CLOUDS,MIST
	SOLID	GAS	SMOKE, EXHAUST
FOAM	GAS	LIQUID	SHAVING CREAM
	GAS	SOLID	FOAM, RUBBER, SPONGE
EMULSION	LIQUID	LIQUID	FACECREAM, MILK
SOL	SOLID	LIQUID	MILK OF MAGNESIA, MUD
GEL	LIQUID	SOLID	JELLY, CHEESE, BUTTER
SOLID SOL	SOLID	SOLID	COLOURED GEMSTONE, MILKY GLASS

To distinguish a colloid from a solution

- **A solution which scatters a beam of light passing through it renders its path visible, will be a colloid**

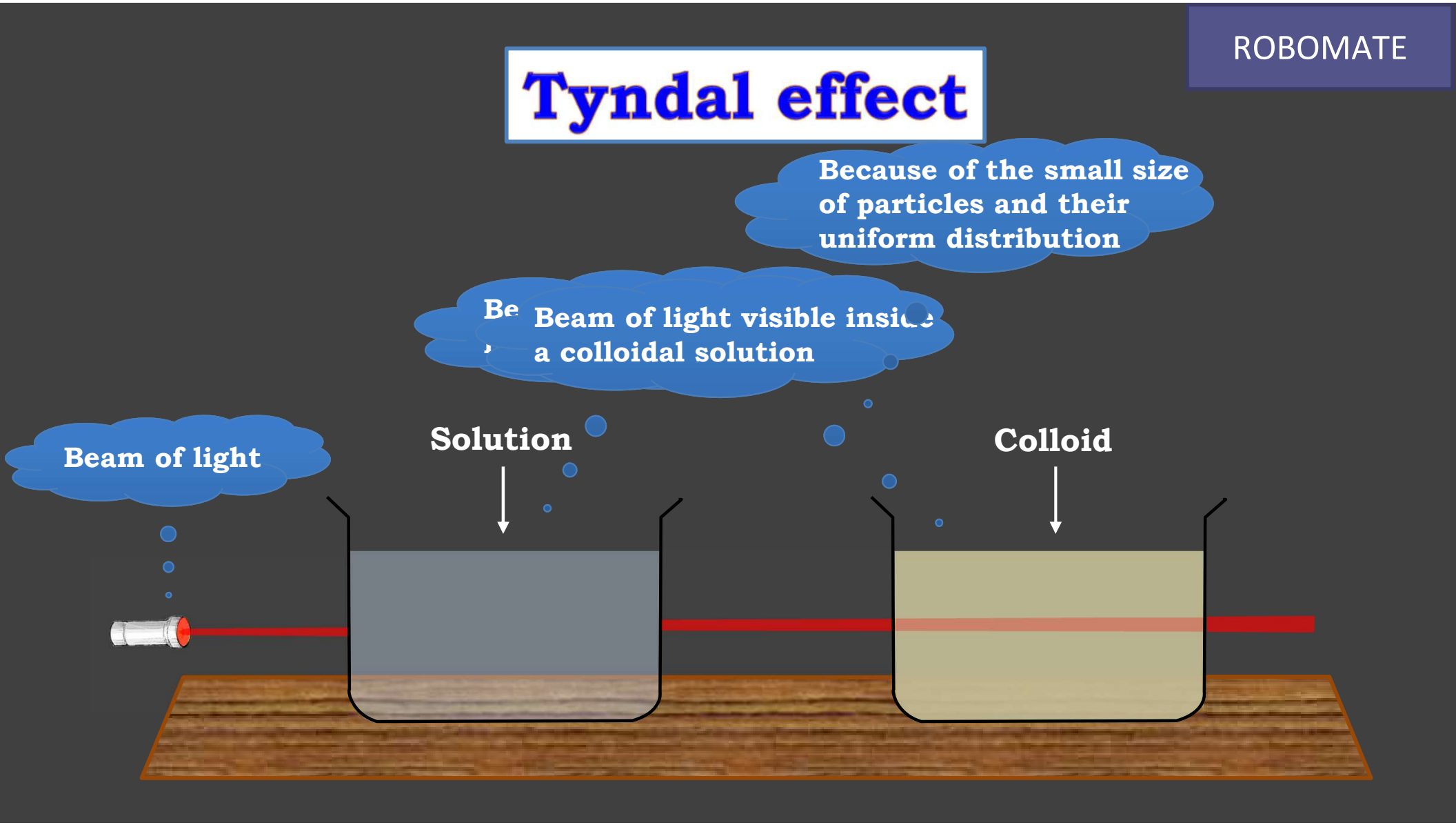
- **The solution which does not scatter a beam of light passing through it and does not render its path visible, will be a true solution**

MODULE : 10

- **Tyndall effect and distinguish between solution, suspension and colloids**

ROBOMATE

Tyndal effect



Solution	Suspension	Colloid
Homogeneous mixture	Heterogeneous mixture	Appears to be homogeneous but actually it is heterogeneous
Cannot be separated by filtration	Can be separated by filtration	Cannot be separated by filtration
Particle size ≤ 1 nm in diameter	Particle size ≥ 100 nm in diameter	Particle size between 1 nm and 100 nm in diameter
Very stable particles do not separated out on standing	Unstable; particles settle down after sometime	Particles do not separate out on standing
The particles cannot be seen even with a microscope	Scatter a beam of light passing through it	Scatter a beam of light passing through it
Does not scatter light	Can be easily seen	Bigger than those in a true solution but smaller than those in a suspension

MODULE : 11

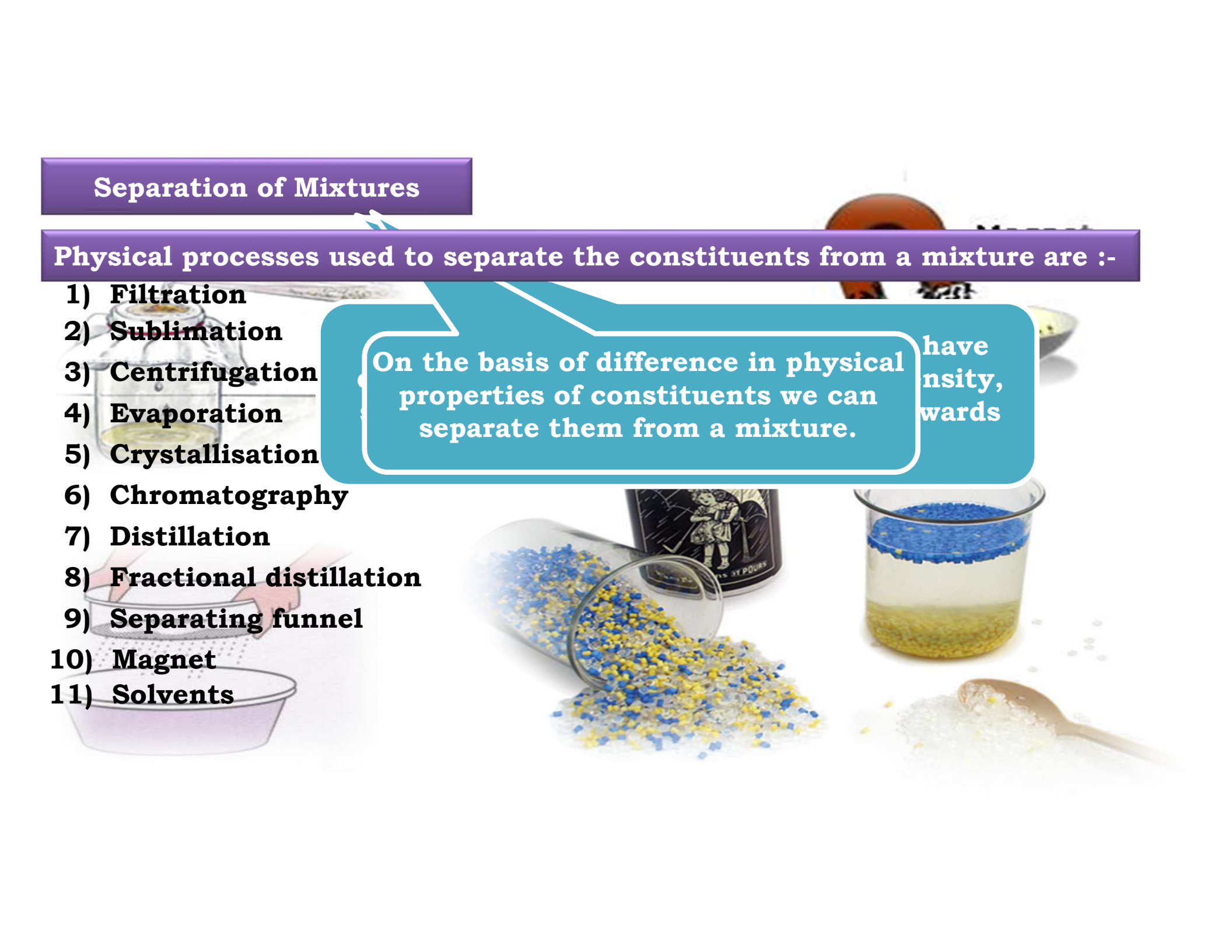
- **Separation of mixture by physical method**

Separation of Mixtures

Physical processes used to separate the constituents from a mixture are :-

1) Filtration
2) Sublimation
3) Centrifugation
4) Evaporation
5) Crystallisation
6) Chromatography
7) Distillation
8) Fractional distillation
9) Separating funnel
10) Magnet
11) Solvents

On the basis of difference in physical properties of constituents we can separate them from a mixture.



Uses g a magnet ls:

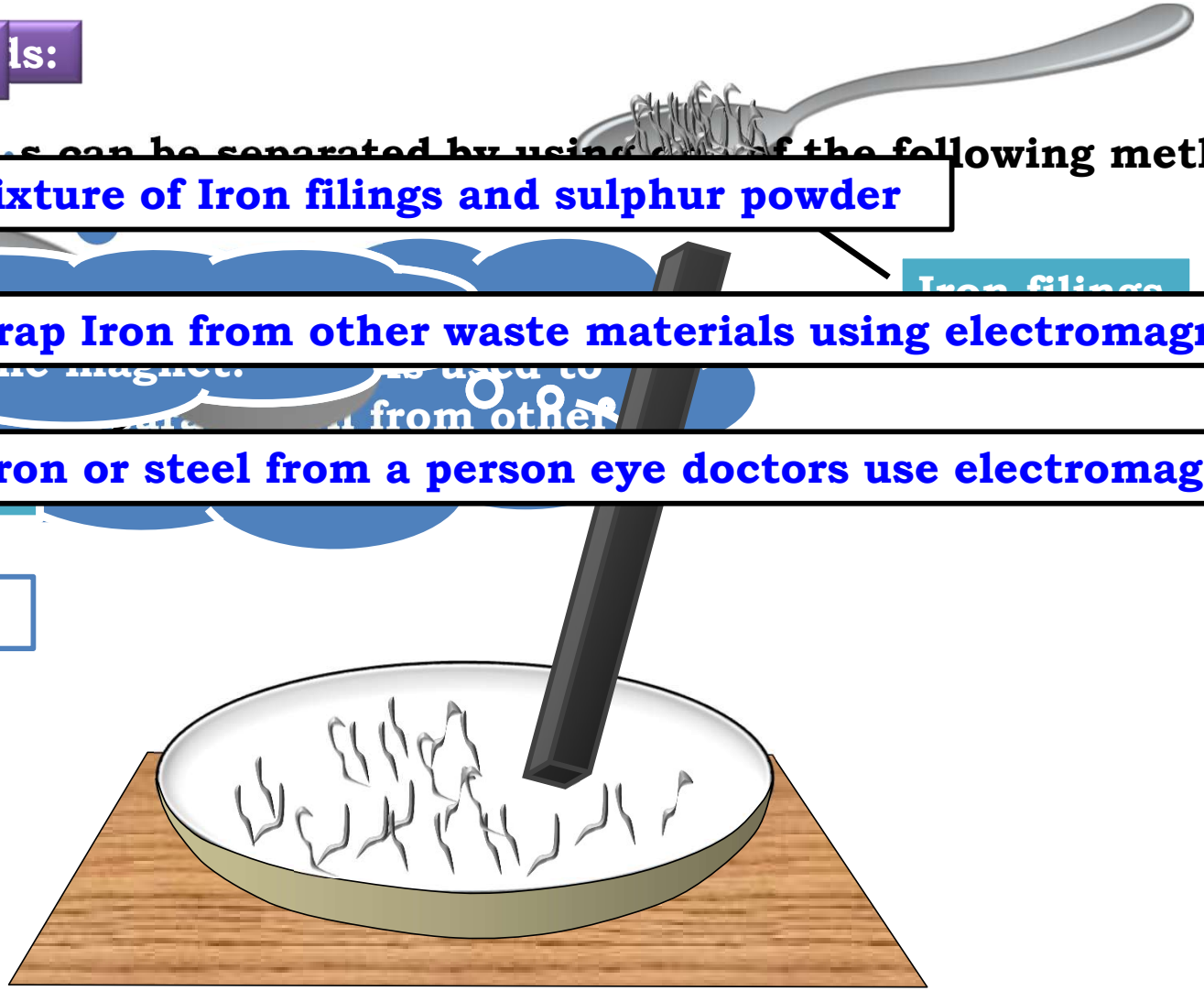
Two solid substances can be separated by using one of the following method :-

1) To separate a mixture of Iron filings and sulphur powder

2) Separation of scrap Iron from other waste materials using electromagnet

3) For removal of Iron or steel from a person eye doctors use electromagnets

iv) Crystallisation



Uses

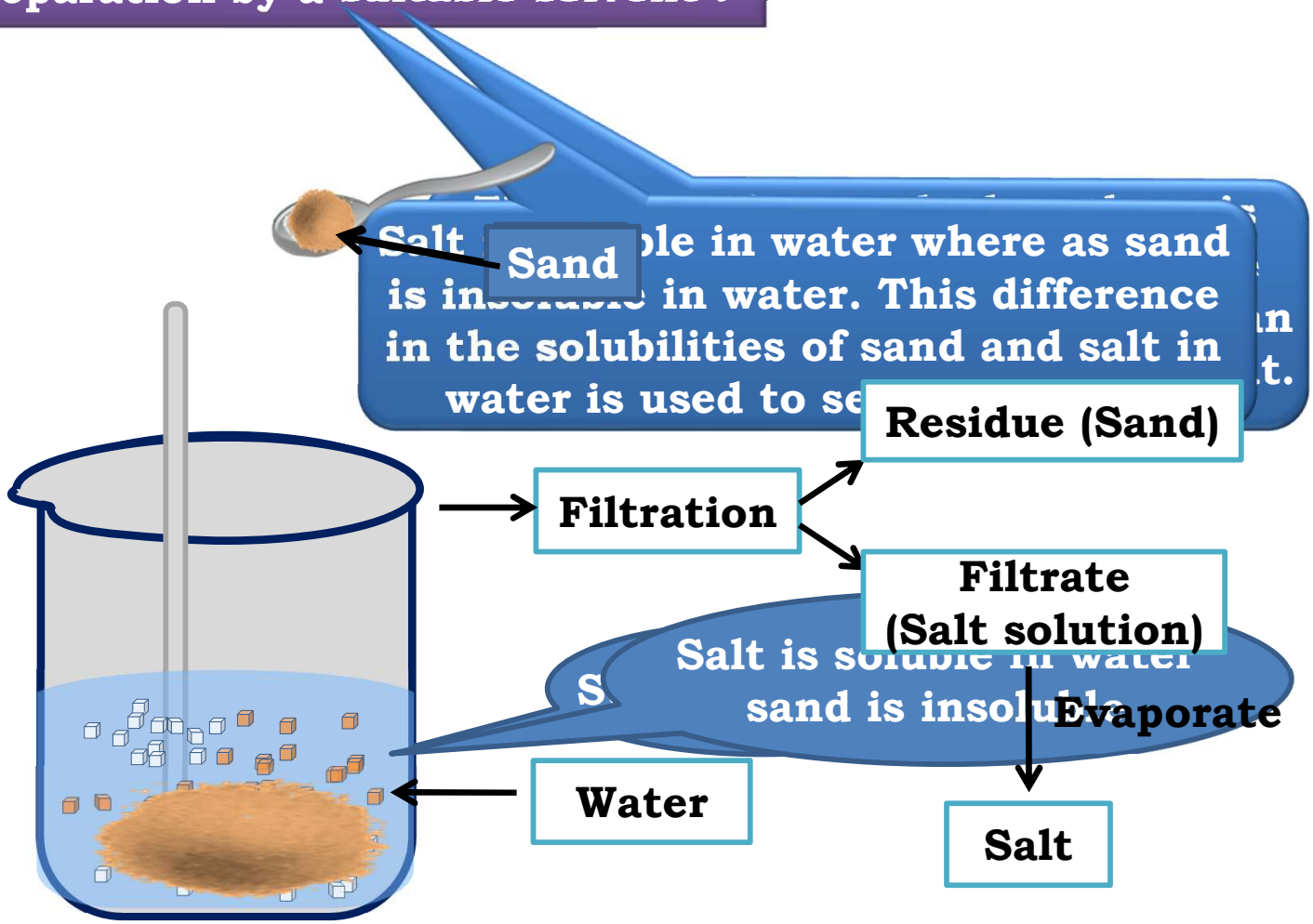
ATION OF AMMONIUM CHLORIDE AND COMMON SALT

Ammonium chloride, Iodine, Camphor, Naphthalene and anthracene can be separated from non-volatile substances like common salt (sodium chloride), sand, iron filings, chalk etc, by the process of sublimation.

MODULE : 12

- **Separation of mixture by physical method (crystallization)**

Separation by a suitable solvent :-



Uses

Separation of carbon and sulphur.

Both are insoluble in water.
Solvent used is carbon disulphide

On evaporating the filtrate, Carbon
isulphide solvent is evaporated
id sulphur remains behind.

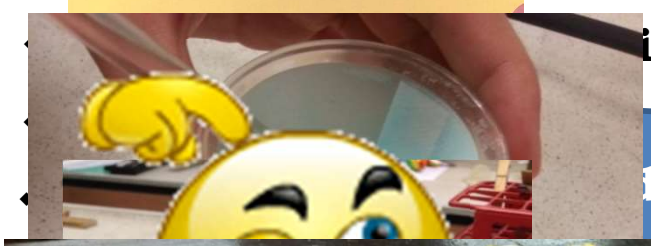
carbon + sulphur mixture in carbon disulphide → Filtration → Residue (Carbon)

Filtration → Filtrate (Sulphur solution) → Evaporate → Sulphur

Sulphur is soluble in carbon disulphide where as carbon is insoluble in carbon disulphide

To obtain pure copper sulphate from an impure sample

- The process of cooling a hot, concentrated solution of a substance to obtain crystal is called crystallization
- Copper sulphate solution

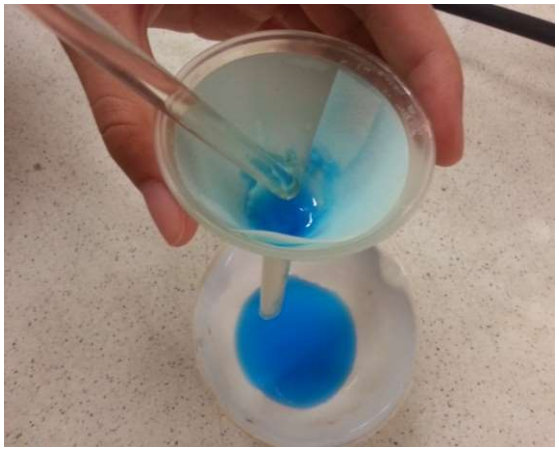


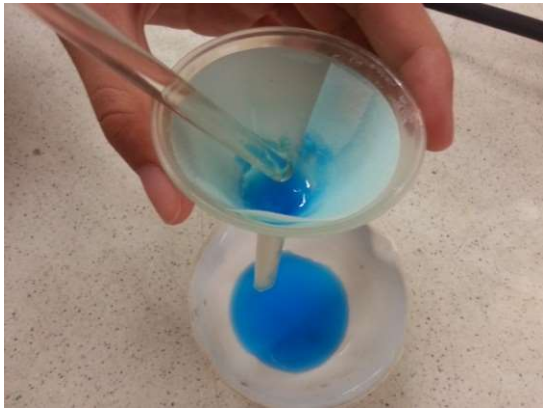
Take about 10 grams of impure copper

Crystal of pure copper sulphate crystal are formed. Impurities remain behind in the solution

olution from time
ystal form on the
n is saturated.
ing

To obtain pure copper sulphate from an impure sample





MODULE : 13

- **Separation of mixture (Filtration and centrifugation)**

Separation of mixture of a solid and liquid

All the mixtures containing a solid and a liquid are separated by one of the following processes

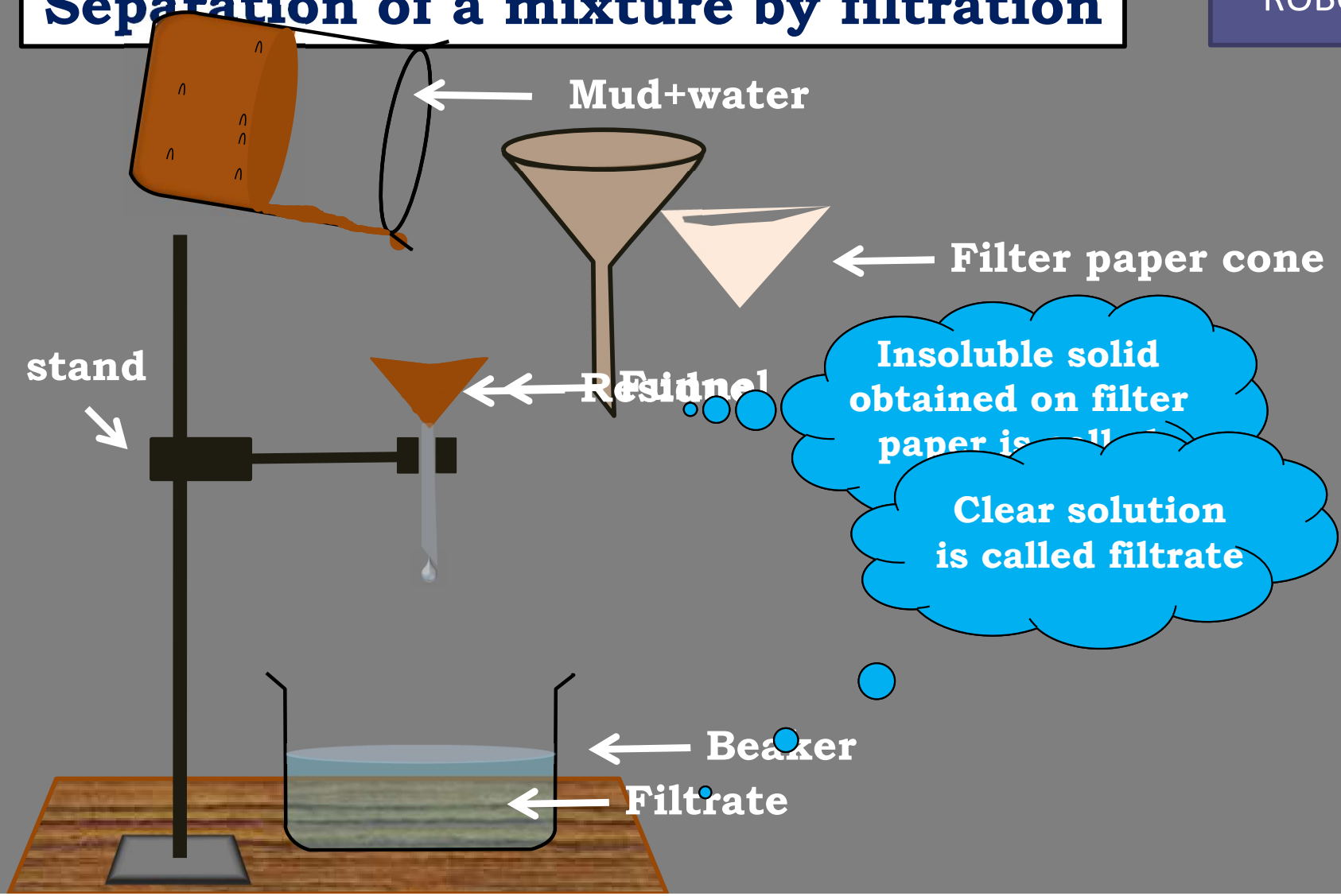
Filtration

Filtration is used for separation of a heterogeneous mixture of a solid and liquid using a filter paper .

- Filtration
- Centrifugation
- Evaporation
- Crystallization
- Chromatography
- Distillation

Separation of a mixture by filtration

ROBOMATE



Uses

- The used te
  from prepar

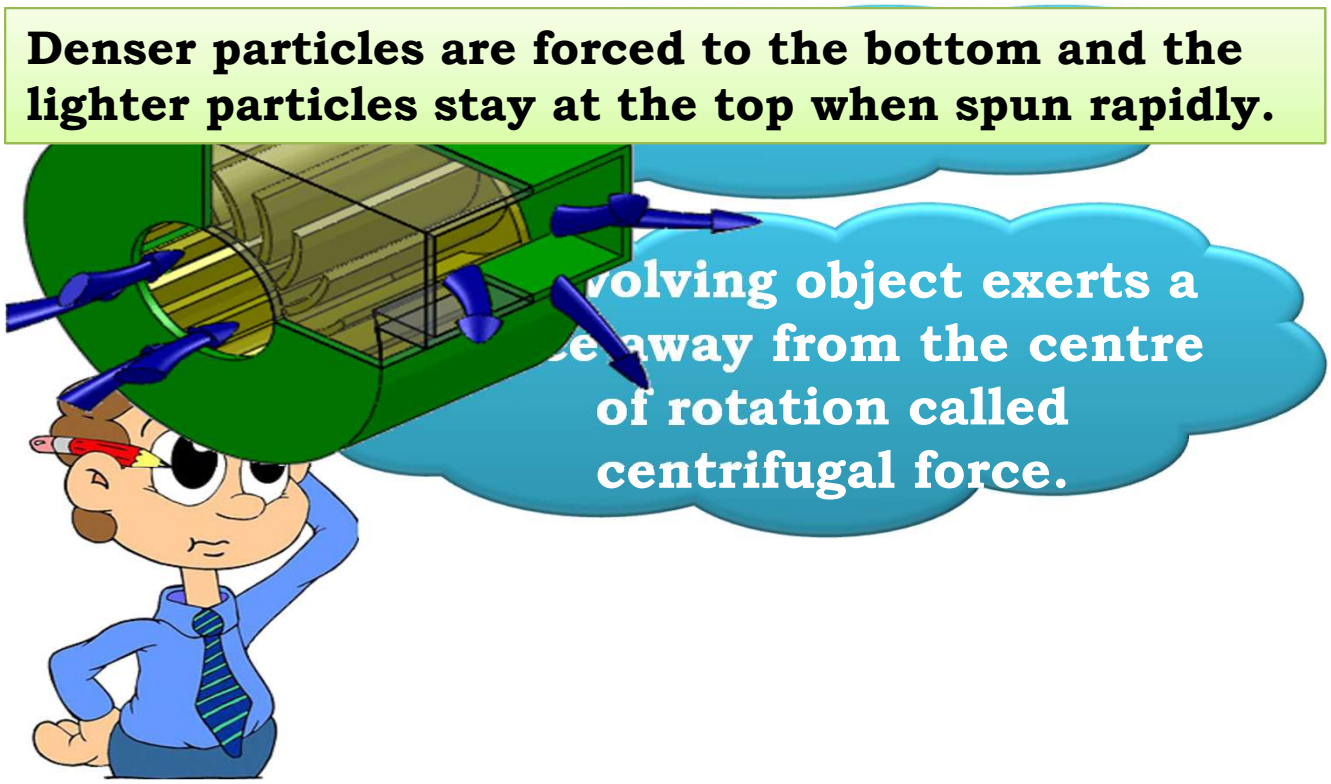
Different filters used in every day life are wire-mesh, piece of cotton, muslin cloth

- Home filters

Centrifugation

Centrifugation is a method for separating the suspended particles of a substance from a liquid in which the mixture is rotated (using centrifugal force) at a high speed in a centrifuge.

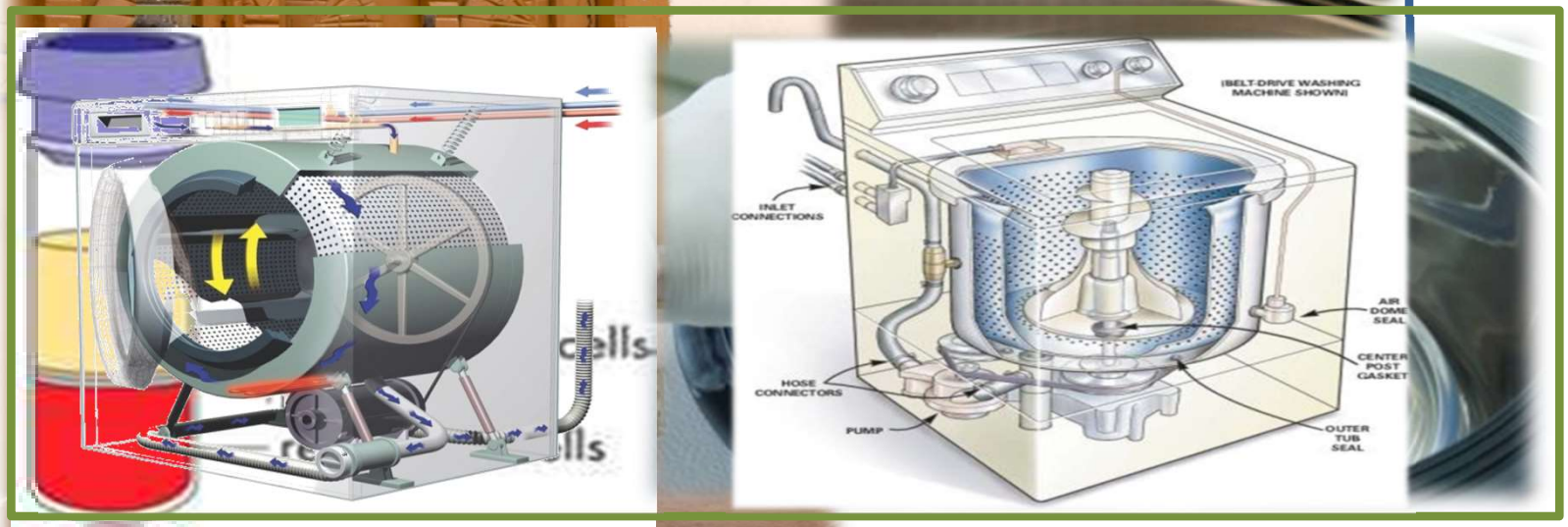
Denser particles are forced to the bottom and the lighter particles stay at the top when spun rapidly.



Uses

WASHING MACHINE RIFUGING ILK

To dry cloths in washing machines by squeezing out water from wet cloths

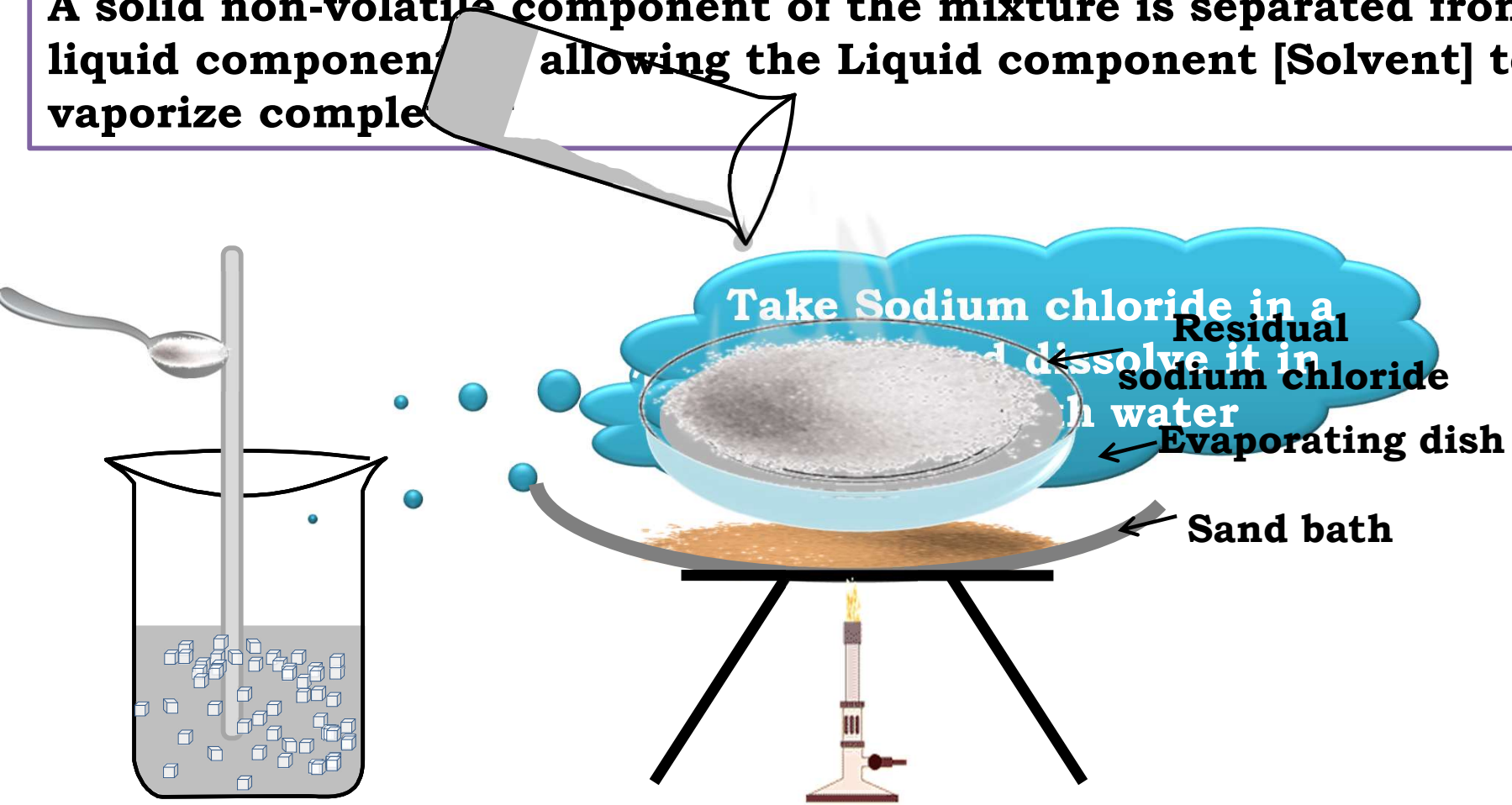


MODULE : 14

- **Evaporation and distillation**

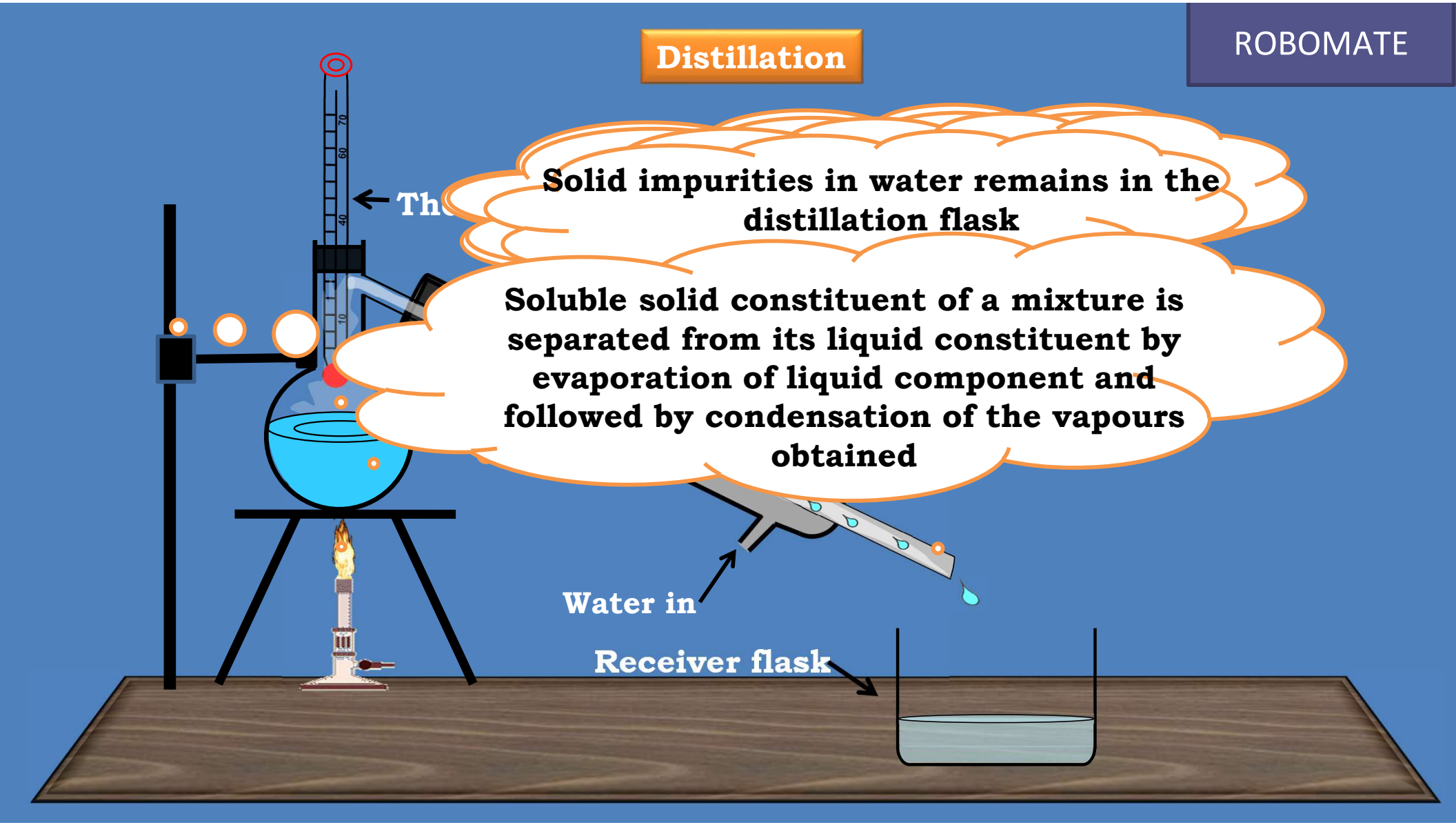
Evaporation

A solid non-volatile component of the mixture is separated from its liquid component allowing the Liquid component [Solvent] to vaporize comple



Crystallization is a better technique than evaporation to dryness

- Some solids (like sugar) decompose or get charred
  to dryness during evaporation.
- Impurities do not get removed in the process
  but such impurities get removed in crystallization.


Distillation
ROBOMATE
Th
Solid impurities in water remains in the distillation flask
Soluble solid constituent of a mixture is separated from its liquid constituent by evaporation of liquid component and followed by condensation of the vapours obtained
Water in
Receiver flask

MODULE : 15

- **Separating funnel and magnetic separation**

Separation of mixture of a liquid and liquid

Immiscible liquids

Liquids which do not mix with each other

Using separating funnel

E.g. ❖ Oil and water

❖ d water

❖ water

Miscible liquids

Liquids which mix with each other

Fractional distillation

Dis

E.g. ❖ Separation of liquefied air

❖ A petroleum products

❖ A

Fractional distillation is used for the separation of miscible liquids for which the difference in their boiling points is less than 25K.

out

SEPARATING TWO IMMISCIBLE LIQUIDS

Immiscible liquids separate out in lay… on their densities using sep…rati…

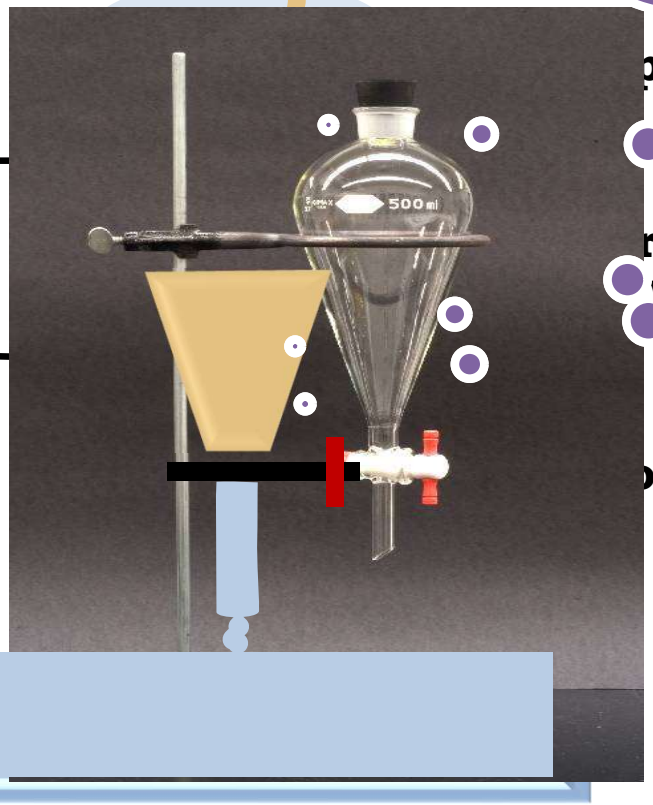
Allow it to stand for sometime so that separate layers of oil and water is formed

…parating funnel

Close the stopcock of the separating funnel as the oil reaches the stop-cock

Oil

Water



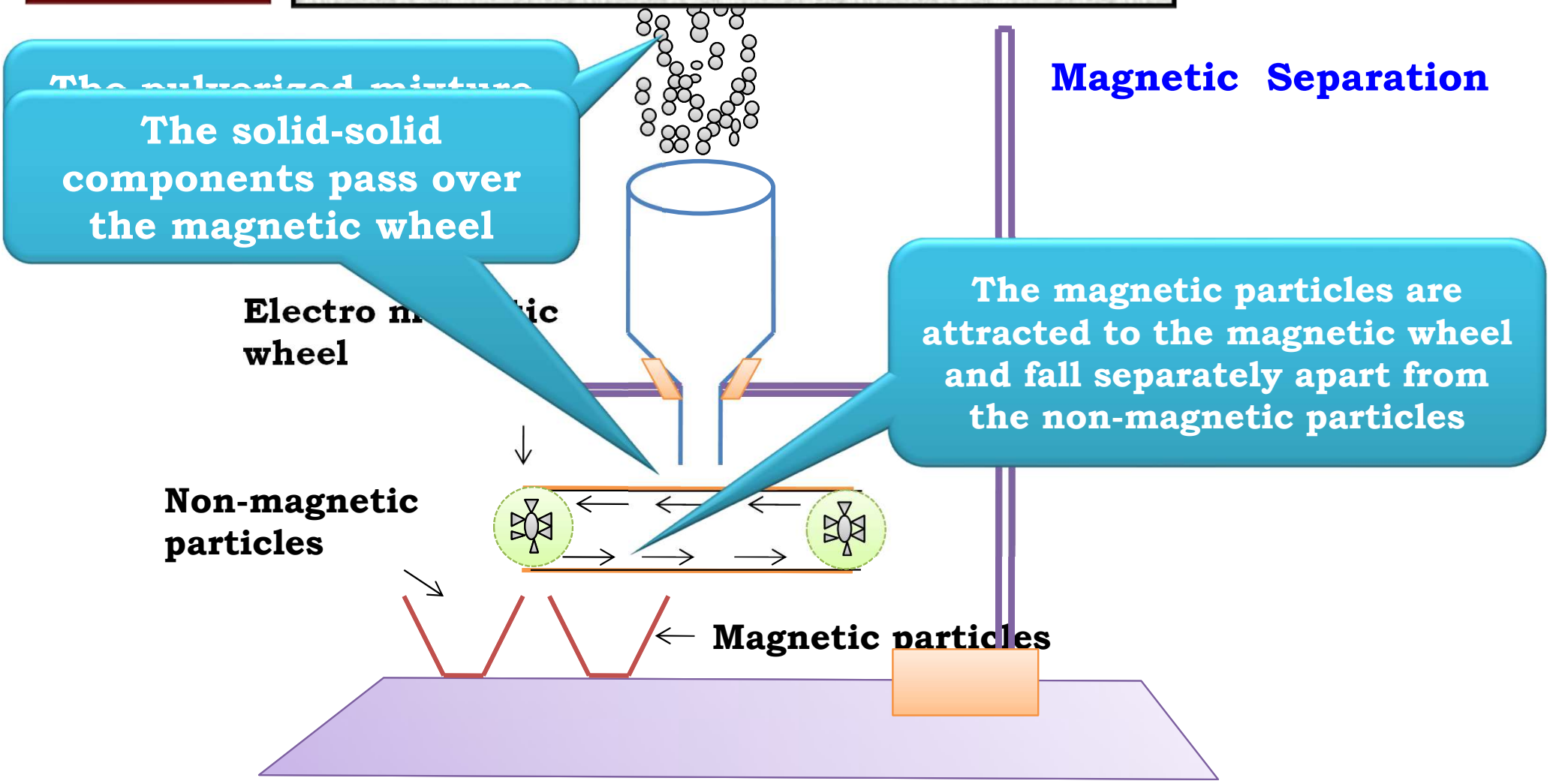
…re

…WATER

…opcock

WATER

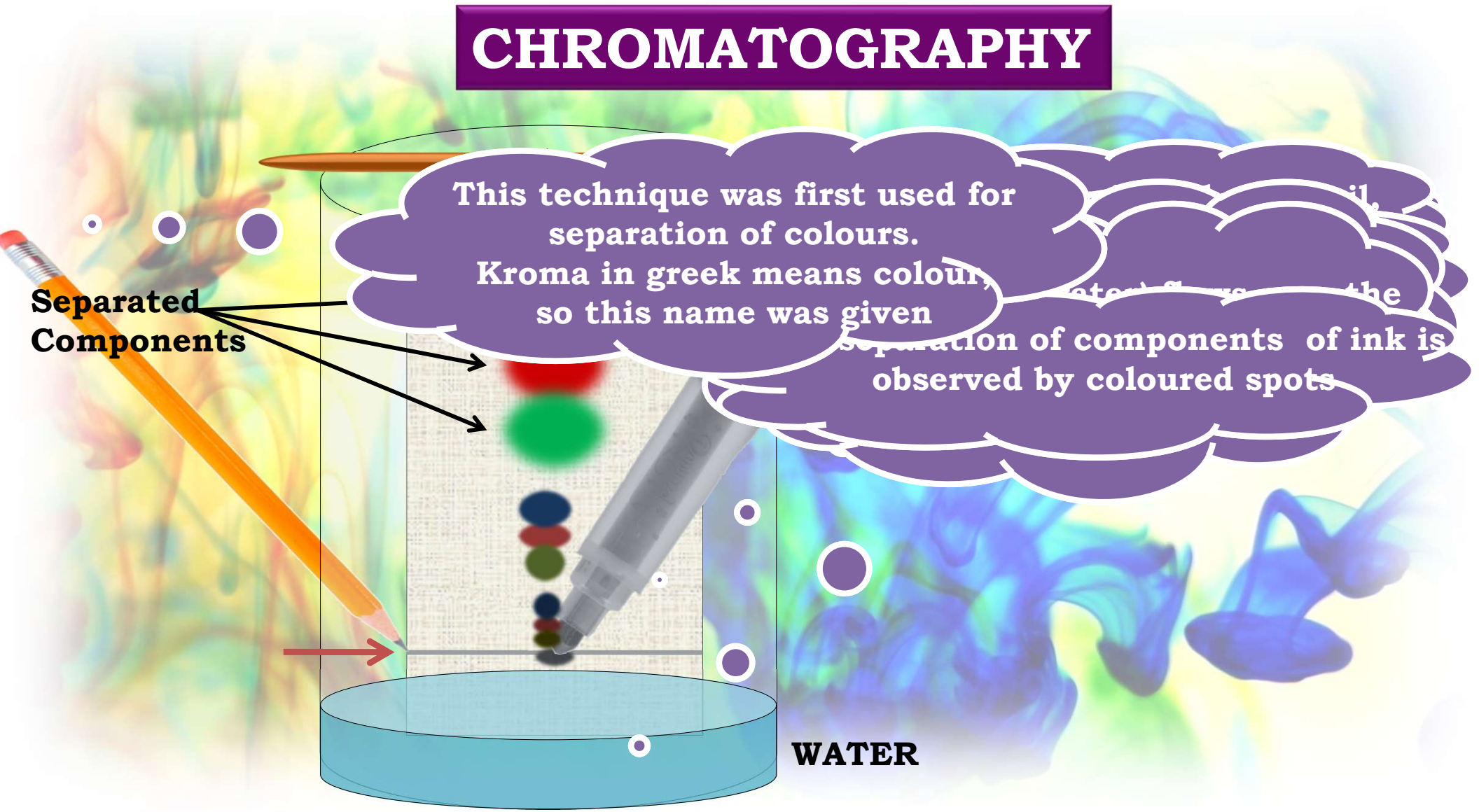
Application **Industrial separation of iron ore from gangue**



MODULE : 16

- **Chromatography**

CHROMATOGRAPHY



CHROMATOGRAPHY

Applications

1. To separate colours in a dye
2. To separate pigments from natural colours
3. To separate drugs from blood

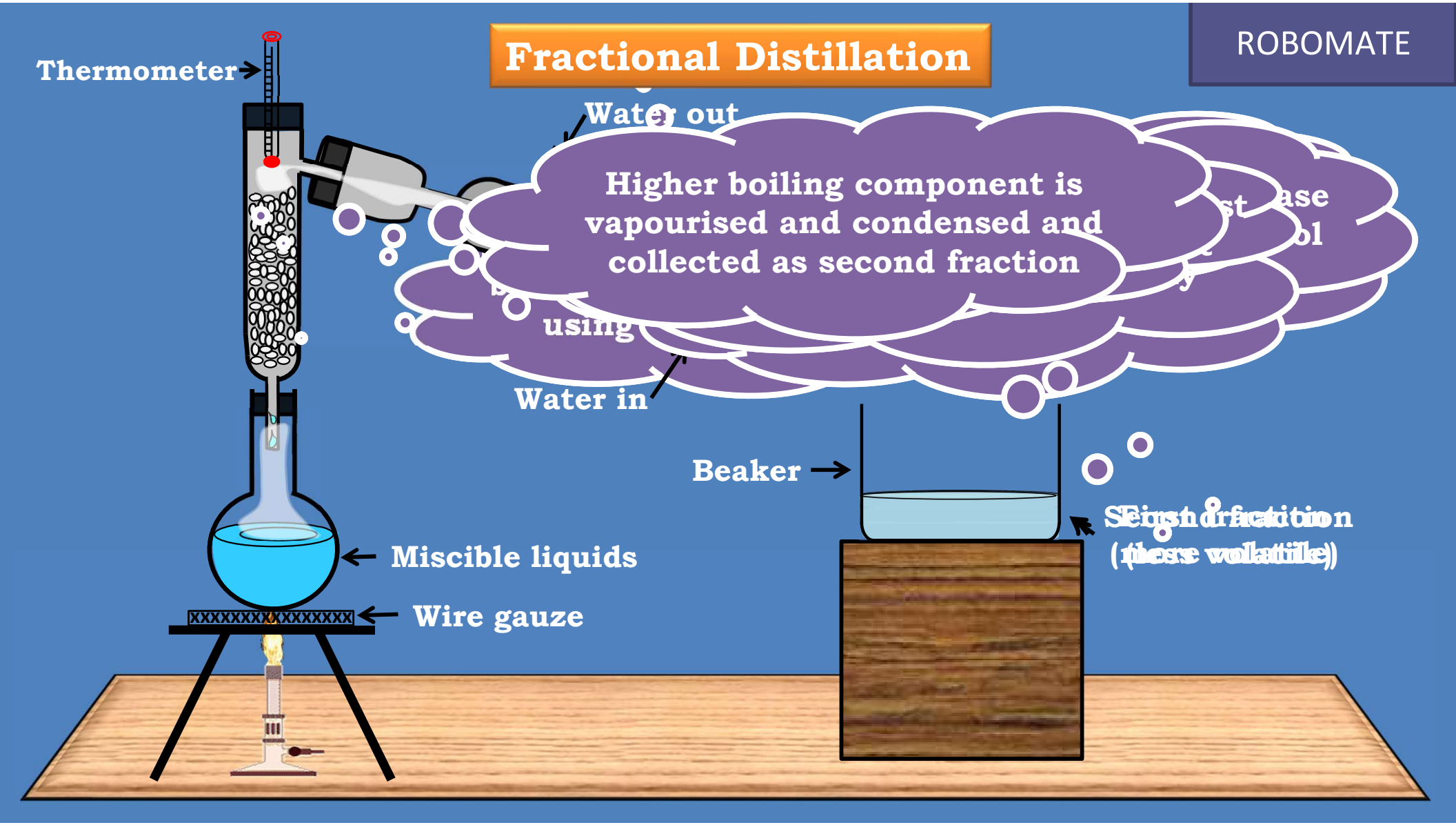
...in black ink a single colour?

What is the reason for the rise of the coloured ...spot on the filter paper ?

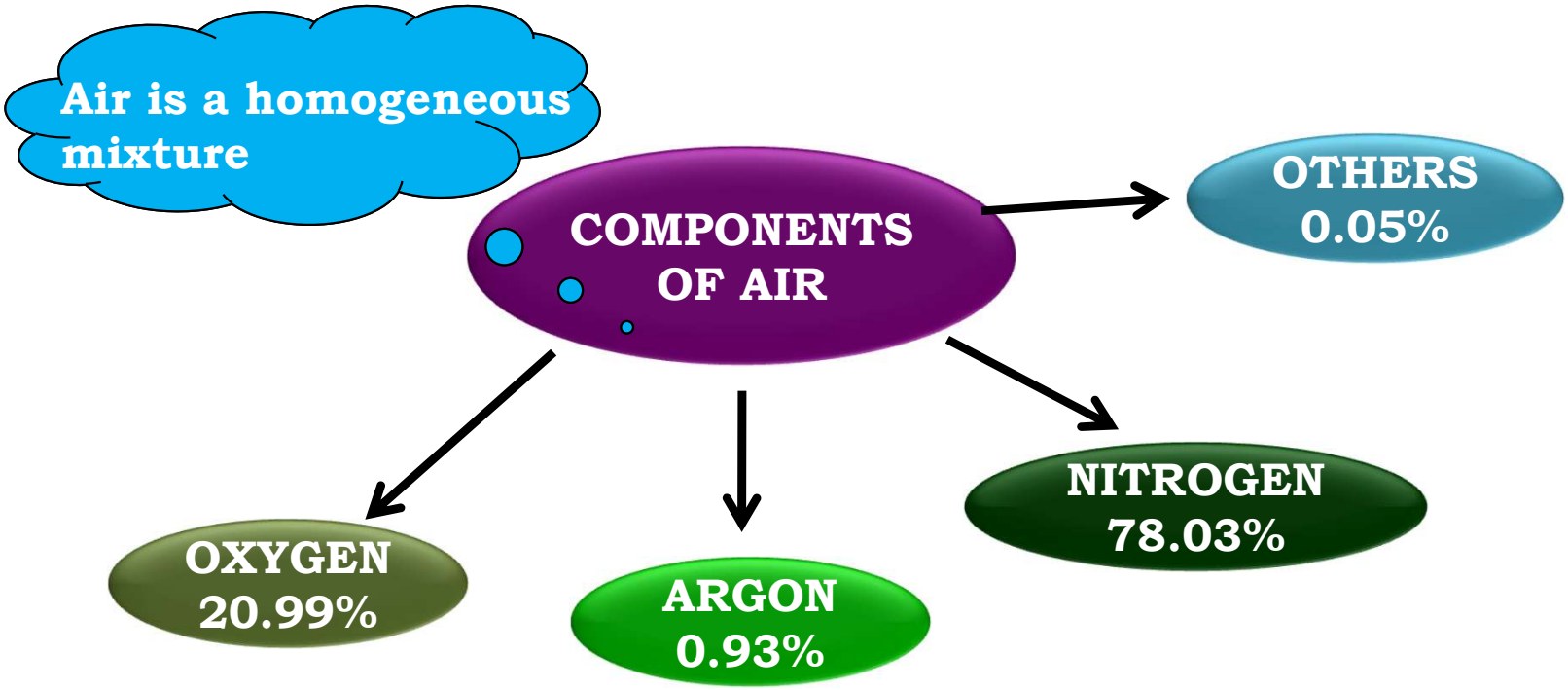
A dye is a mixture of two or more colours. The coloured component that is more soluble in water, rises faster.

MODULE : 17

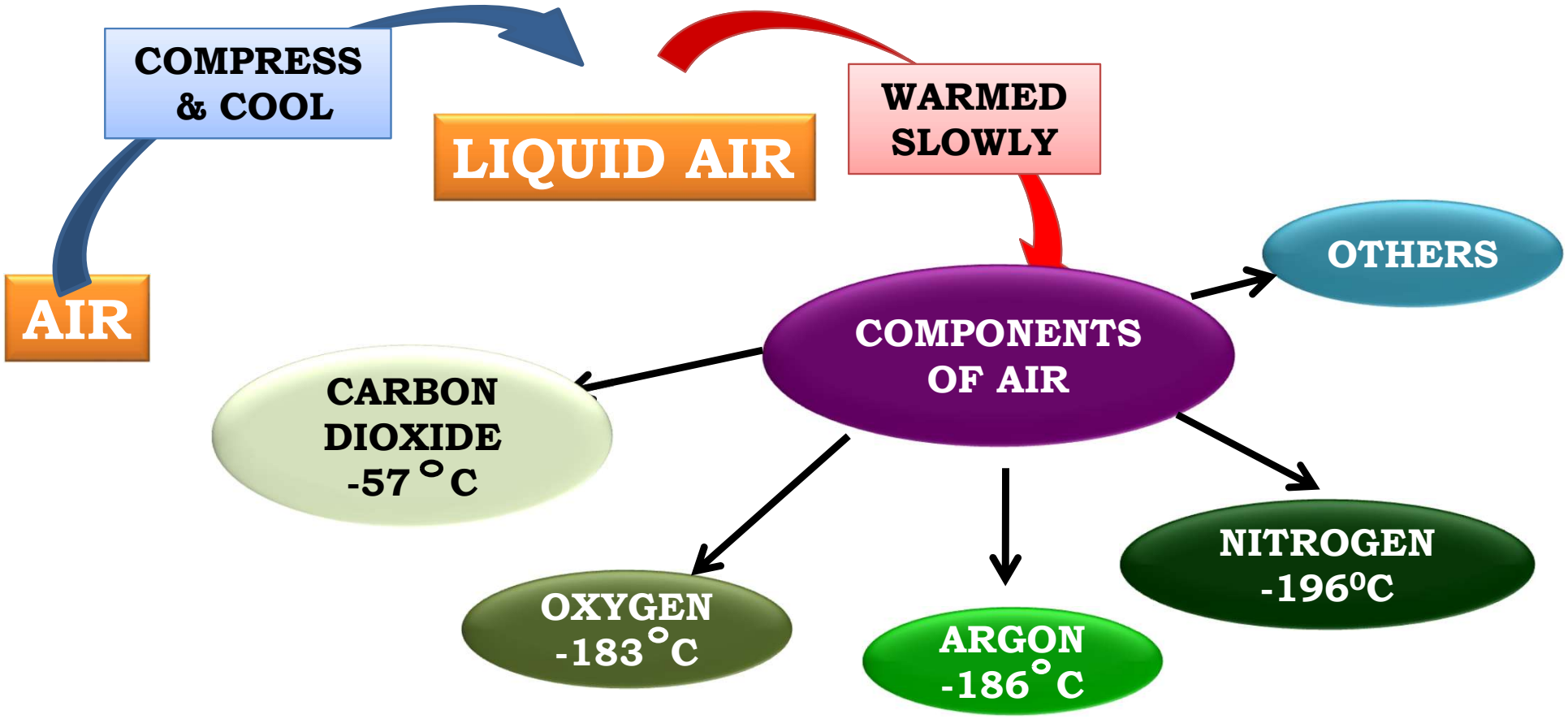
- **Fractional distillation**


Fractional Distillation
ROBOMATE
Thermometer
Water out
Higher boiling component is vapourised and condensed and collected as second fraction
using
Water in
Beaker
Miscible liquids
Wire gauze

Separation of gases of the air

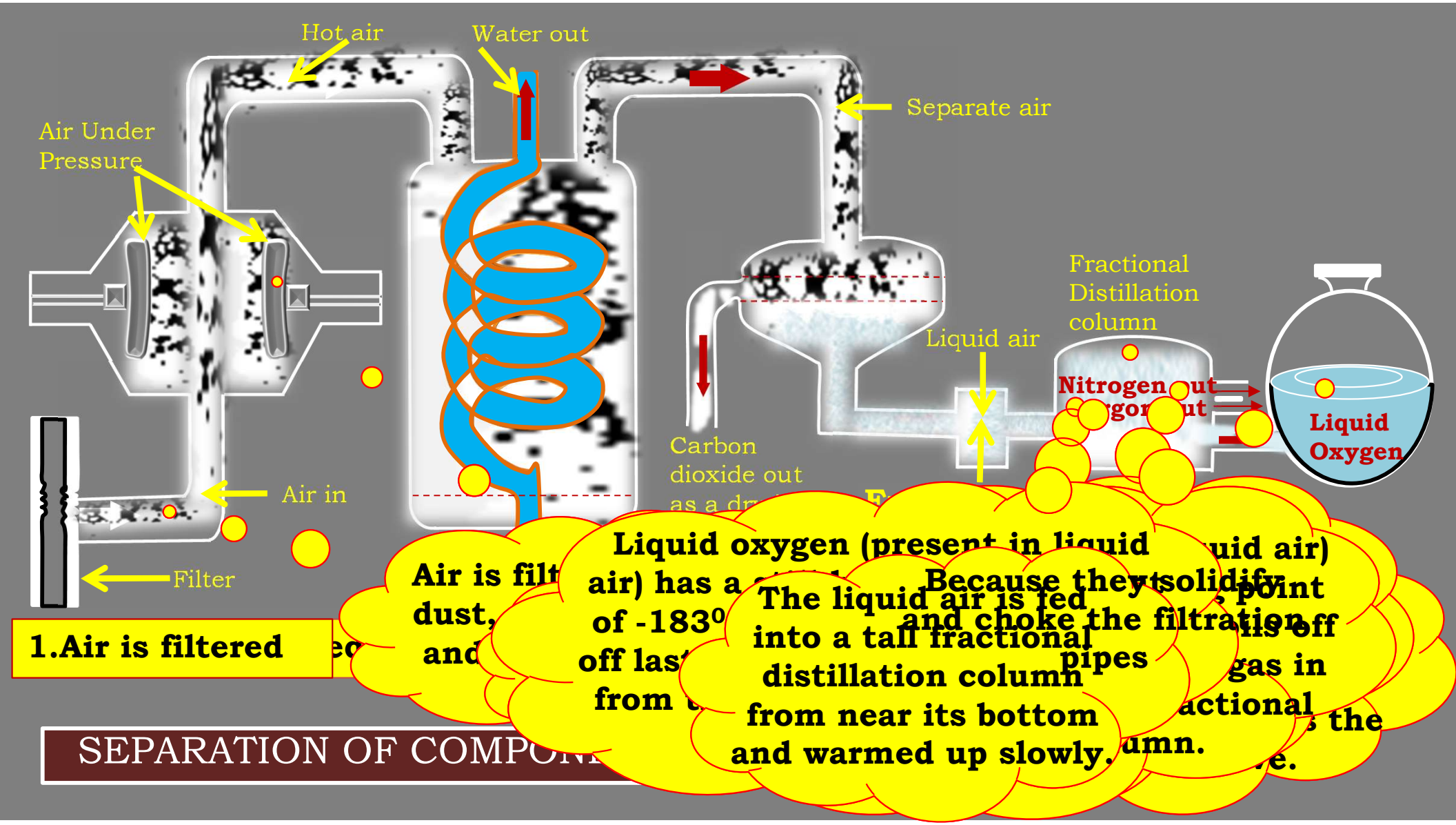


SEPARATION OF COMPONENTS OF AIR



MODULE : 18

- **Fractional distillation of Air**



SEPARATION OF COMPON

Thank You