⇒ matter (पदार्थ)

SAFALTA CLASS™

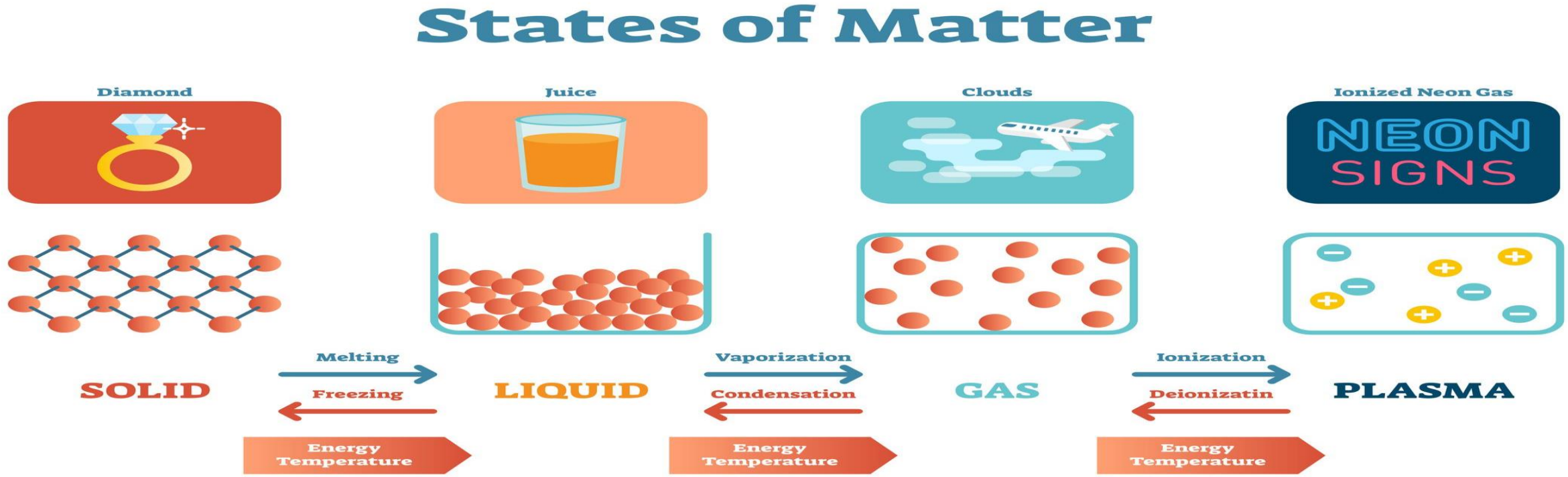
An Initiative by अमर उजाला

MATTER

- Anything that occupies space and has mass and is felt by senses is called matter.

- Matter is the form of five basic elements the Panch tatva –

air , earth ,fire , sky and water.



पदार्थ

- कुछ भी जो व्याप्त है और द्रव्यमान है और इंद्रियों द्वारा महसूस किया जाता है, पदार्थ कहलाता है।

- पदार्थ पंच तत्त्व के पांच मूल तत्वों का रूप है -

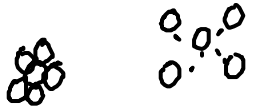
वायु, पृथ्वी, अग्नि, आकाश और जल।

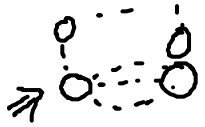
Characteristics of particles of matter

Atom (परमाणु)

- Made of tiny particles.

- Vacant spaces exist in particles.





- Particles are in continuous motion.

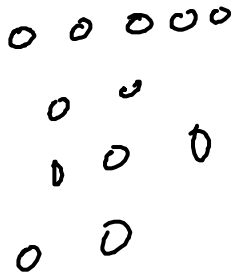
- Particles are held together by forces of attraction.

पदार्थ के कणों की विशेषताएँ

- छोटे कणों से बना है।
- रिक्त स्थान कणों में मौजूद हैं।
- कण निरंतर गति में हैं।
- कण आकर्षण के बल पर एक साथ रखे जाते हैं।

States of Matter

Basis of Classification of Types



Based upon particle arrangement

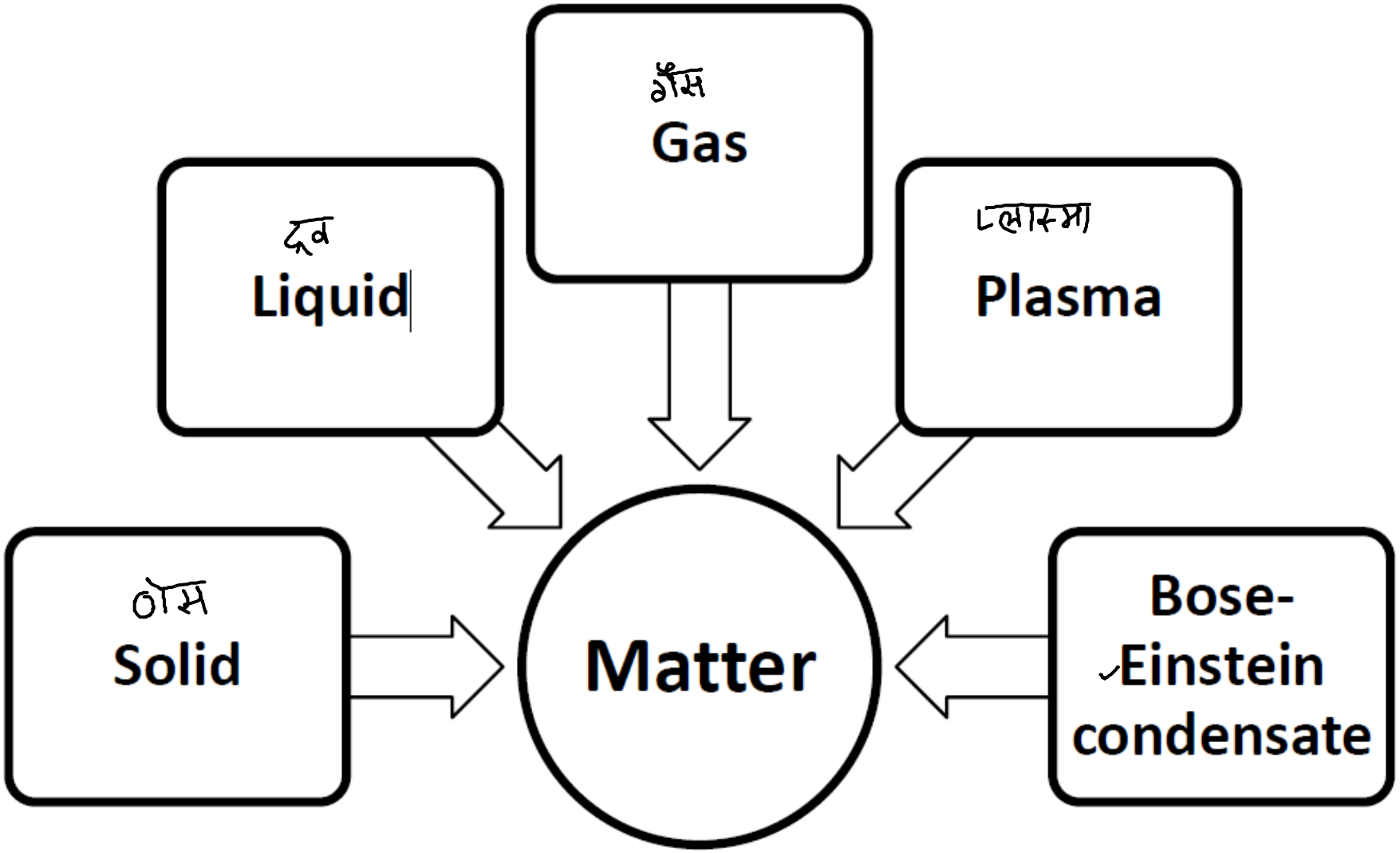
Based upon energy of particles

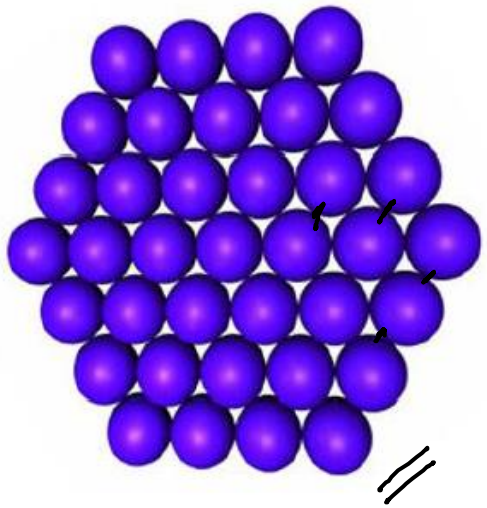
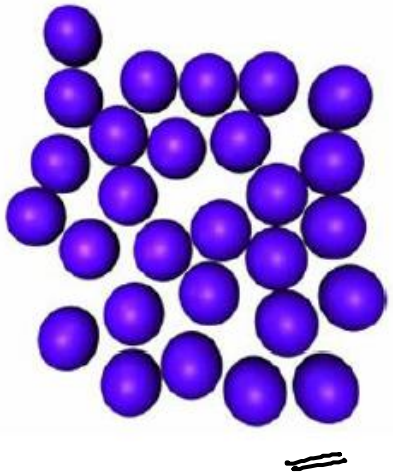
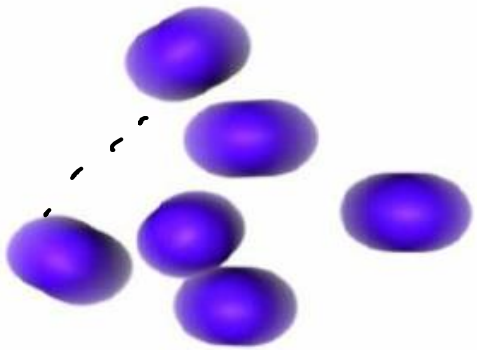
Based upon distance between particles

द्रव्य की अवस्थाएं

- प्रकारों के वर्गीकरण का आधार
- कण व्यवस्था पर आधारित
- कणों की ऊर्जा पर आधारित है
- कणों के बीच की दूरी के आधार पर

Five states of matter :



(i) SOLID	(ii) LIQUID	(iii) GAS
		
1 • Fixed shape and definite volume.	• Not fixed shape but fixed volume.	• Neither fixed shape nor fixed volume.
2 • Inter particle distances are smallest.	• Inter particle distances are larger.	• Inter particle distances are largest.
3 • Incompressible.	• Almost incompressible.	• Highly compressible.
4 • High density and do not diffuse.	• Density is lower than solids and diffuse.	• Density is least and diffuse.

• Inter particle distances are smallest.	• Inter particle distances are larger.	• Inter particle distances are largest.
• Incompressible.	• Almost incompressible.	• Highly compressible.
• High density and do not diffuse.	• Density is lower than solids and diffuse.	• Density is least and diffuse.
5 • Inter particle forces of attraction are strongest.	• Inter particle forces of attraction are weaker than solids .	• Inter particle forces of attraction are weakest.
4 • Constituent particles are very closely packed.	• Constituent particles are less closely packed.	• Constituent particles are free to move about.

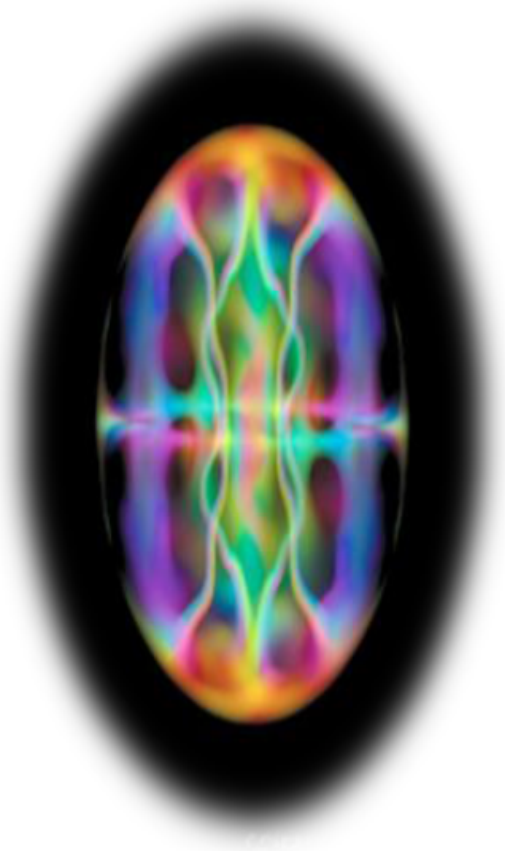
(iv) Plasma (non –evaluative)

- A plasma is an ionized gas. (आयनीकृत)
- A plasma is a very good conductor of electricity and is affected by magnetic fields. High Temp. (उच्च तापमान)
- Plasma, like gases have an indefinite shape and an indefinite volume. Ex. Ionized gas

$NaCl + H_2O \rightarrow Na^+ + Cl^-$

O_2 $O^=$

(v) Bose-Einstein condensate (non –evaluative)



- A **BEC** is a state of matter that can arise at very low temperatures. Bosons 48
- The scientists who worked with the Bose-Einstein condensate received a Nobel Prize for their work in 1995.
- The BEC is all about molecules that are really close to each other (even closer than atoms in a solid).

Microscopic Explanation for Properties of Solids

Solids have a definite shape and a definite volume because the particles are locked into place

Solids do not flow easily because the particles cannot move/slide past one another

Solids are not easily compressible because there is little free space between particles

Microscopic Explanation for Properties of Liquids

Liquids are not easily compressible and have a definite volume because there is little free space between particles.

Liquids have an indefinite shape because the particles can lide past one another.

Liquids flow easily because the particles can move/slide past one another.

Microscopic Explanation for Properties of Gases

Gases are easily compressible because there is a great deal of free space between particles

Gases flow very easily because the particles randomly move past one another.

Gases have an indefinite shape and an indefinite volume because the particles can move past one another.

Microscopic Explanation for Properties of Plasmas

Plasmas have an indefinite shape and an indefinite volume because the particles can move past one another.

Plasmas are easily compressible because there is a great deal of free space between particles.

Plasmas are good conductors of electricity &are affected by magnetic fields because they are composed of ions

Microscopic Explanation for Properties of BEC

Particles are less energetic than solids because Exist at very low temperature .

Particles are literally indistinguishable because they are locked into same space .

BEC shows superfluidity because Particles can flow without friction.

Interchange in states of matter

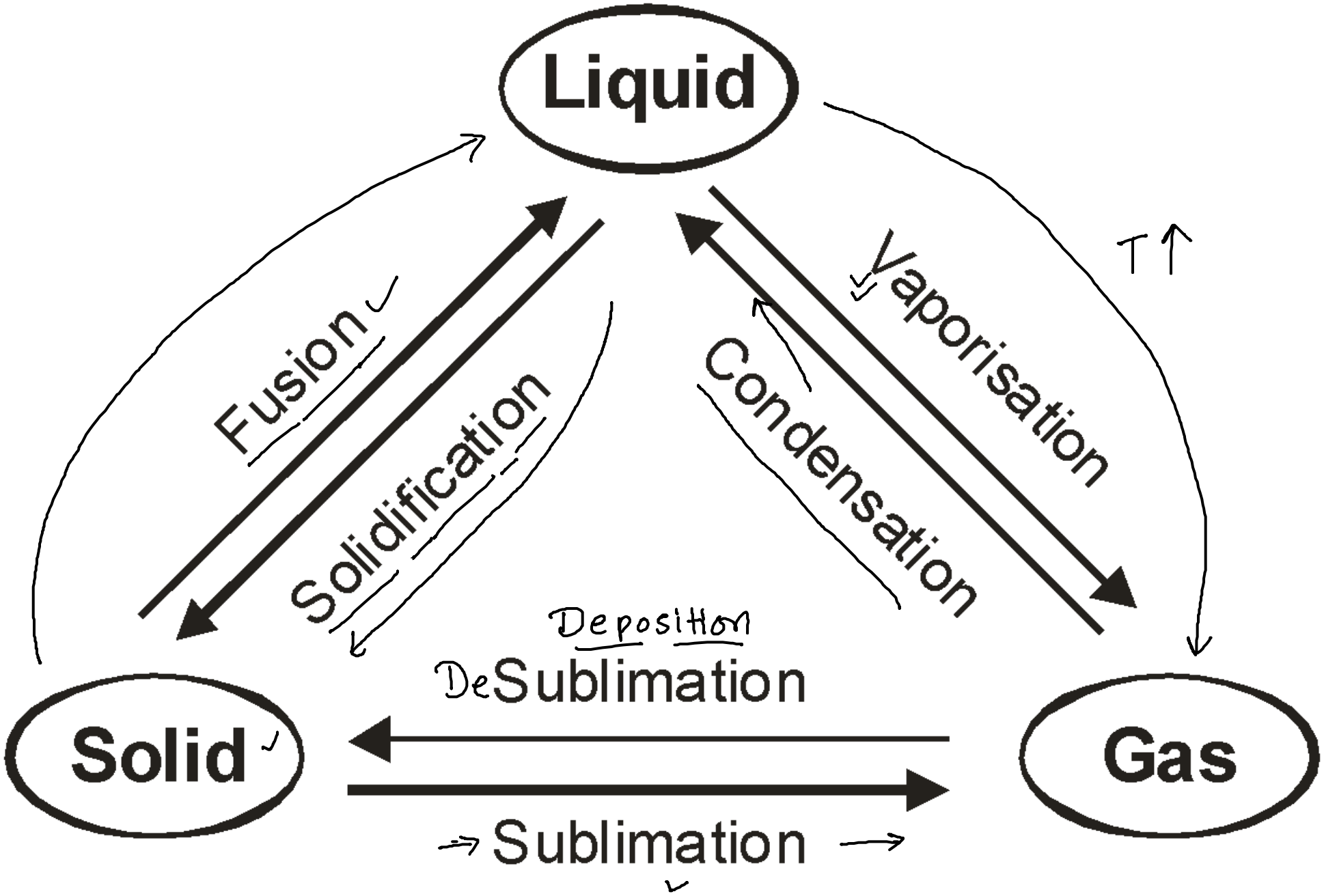
Matter Can Change its State

Water can exist in three states of matter –

- Solid, as ice ,
- Liquid, as the familiar water, and
- Gas, as water vapour.

पदार्थ की अवस्थाओं में परस्पर परिवर्तन

- पदार्थ अपने अवस्थाओं को बदल सकते हैं
- पदार्थ की तीन अवस्थाओं में पानी मौजूद हो सकता है -
- • ठोस, बर्फ के रूप में,
- • तरल, परिचित पानी के रूप में, और
- • गैस, जल वाष्प के रूप में।


Liquid
Solid
Gas
Fusion
Solidification
Vaporisation
Condensation
T↑
Deposition
DeSublimation
Sublimation

Classifying Matter: Elements, तत्व Compounds, and Mixtures

यौगिक

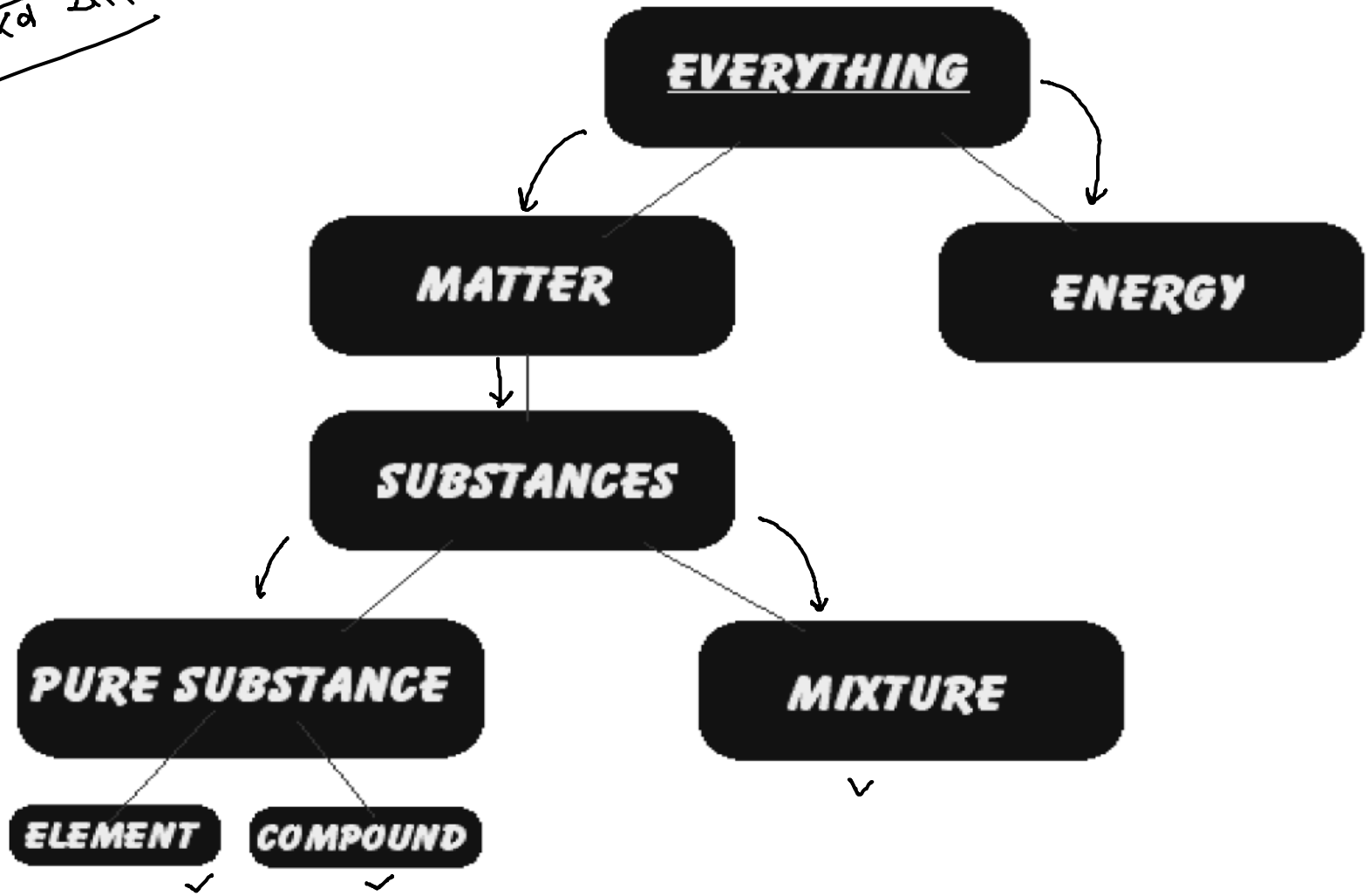
मिश्रण

वर्गीकरण पदार्थ:

तत्व, यौगिक और मिश्रण

Pure Substance & mixture

तत्व एवं यौगिक



Pure Substances

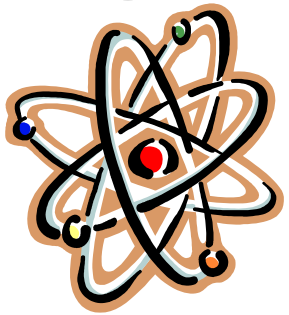
- A sample of matter that has definite chemical and physical properties.

(तत्व)

Elements (118)

(परमाणु)

Atoms

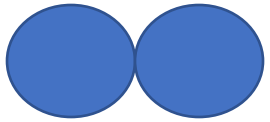


O → element

O+O ⇒ O_2 → molecule

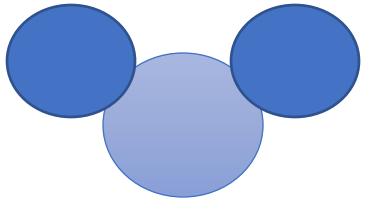
N + N ⇒ N_2 → "

Molecules



Compounds

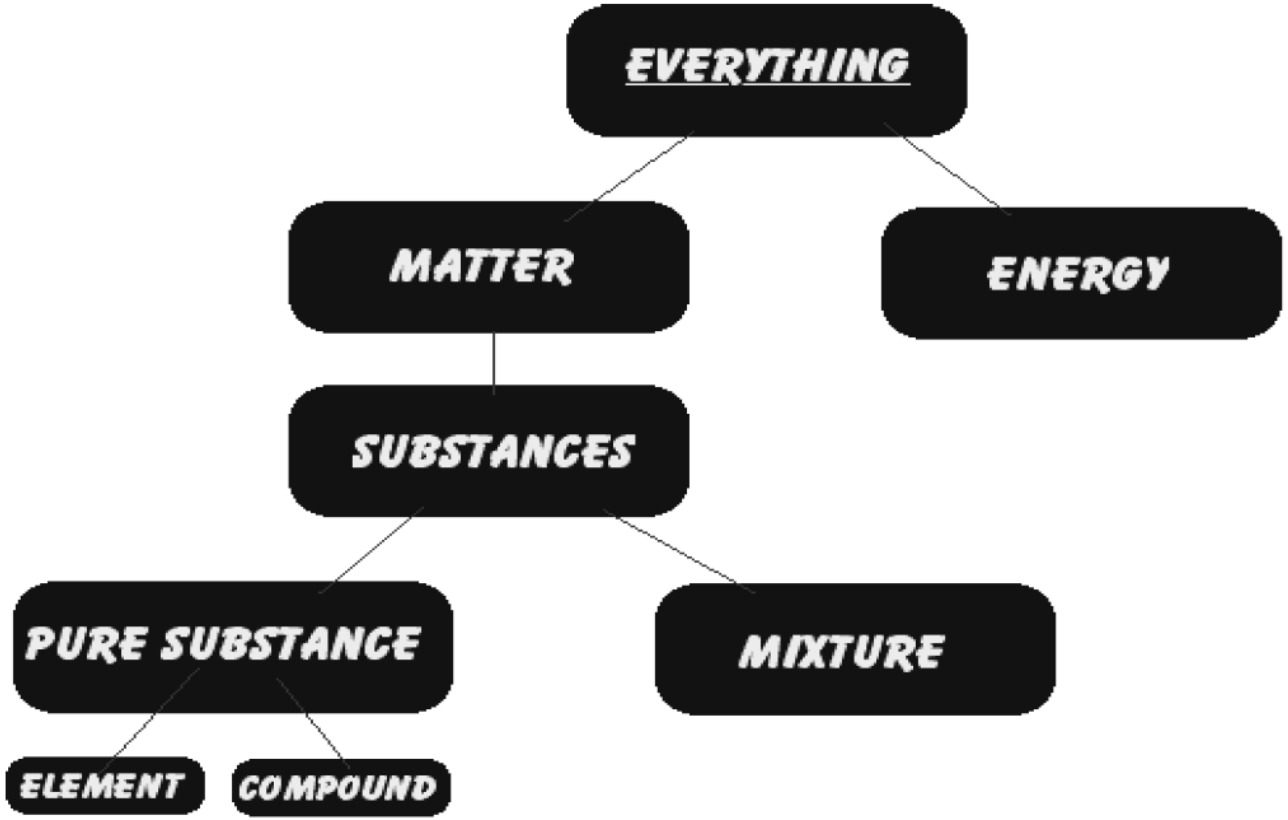
यौगिक



$H_2 + O \rightarrow H_2O$

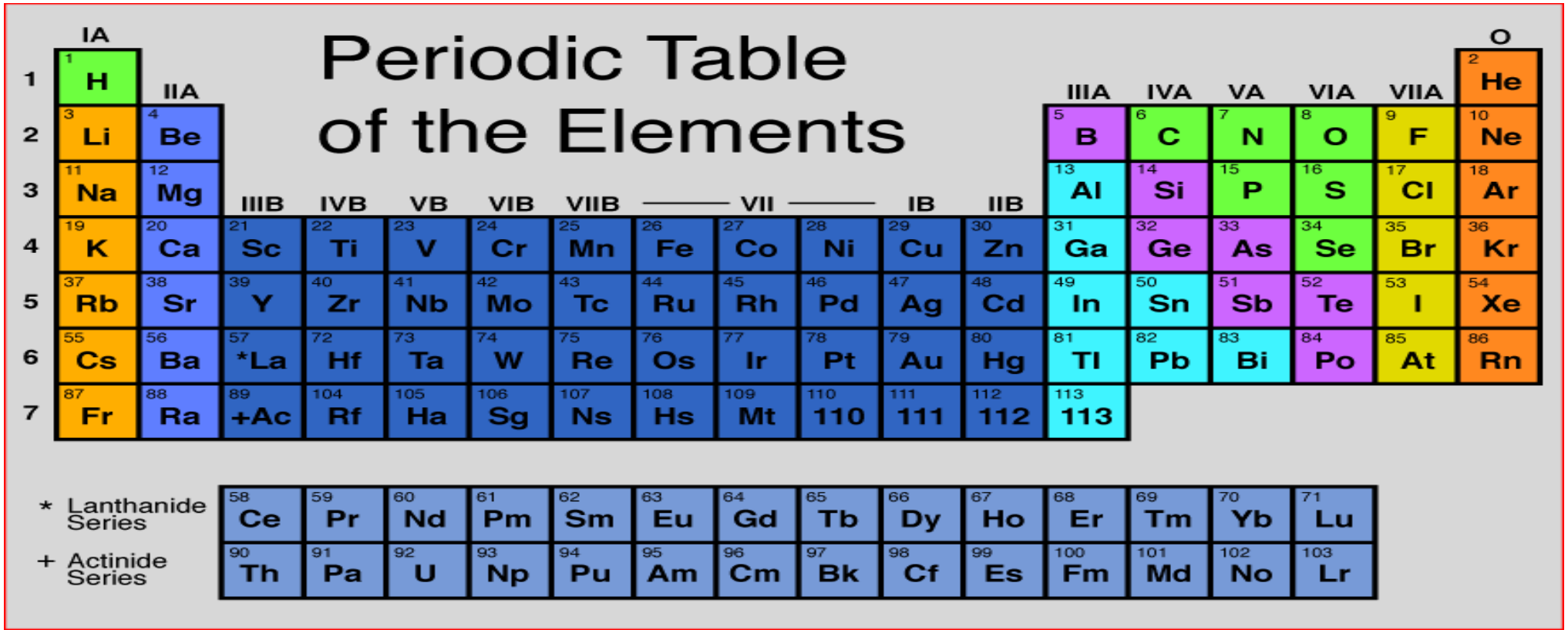
शुद्ध पदार्थ

- पदार्थ का एक नमूना जिसमें निश्चित रासायनिक और भौतिक गुण होते हैं।



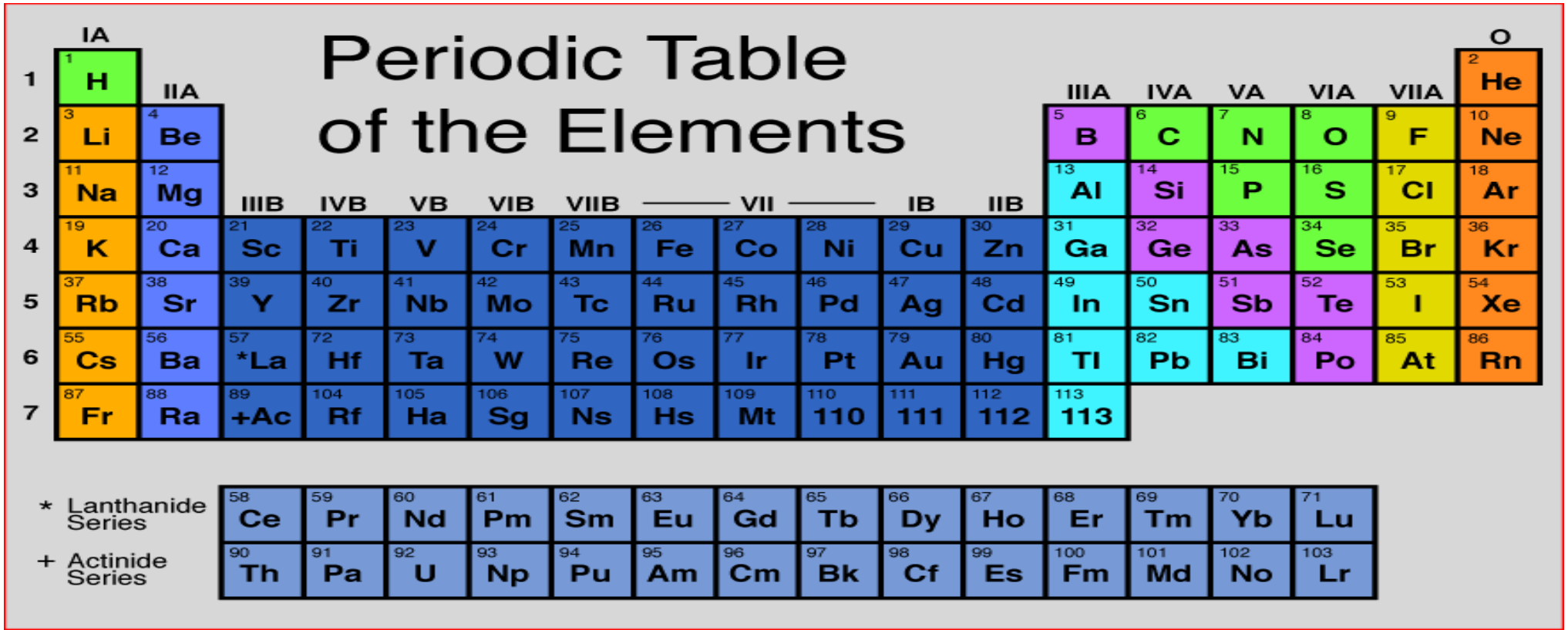
Elements

- pure substance that cannot be separated into simpler substance by physical or chemical means. 118



तत्व

- शुद्ध पदार्थ जिसे भौतिक या रासायनिक साधनों द्वारा सरल पदार्थ में अलग नहीं किया जा सकता है।



Compounds (यौगिक)

Pure substance composed of two or more *different elements joined by chemical bonds.*

- Made of elements in a specific ratio that is always the same
- Has a chemical formula
- Can only be separated by chemical means, not physically

H_2O

$NaCl$

CO_2

यौगिक

- दो या दो से अधिक विभिन्न तत्वों से बना शुद्ध पदार्थ रासायनिक बंधों से जुड़ता है।

- एक विशिष्ट अनुपात में तत्वों से बना
- वह हमेशा एक ही है

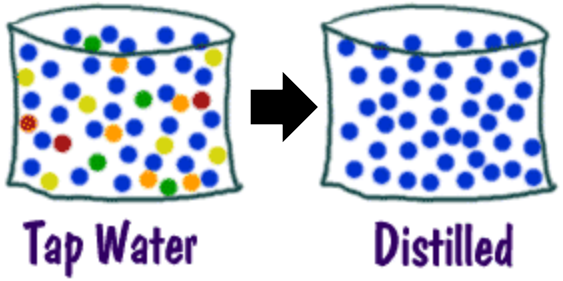
- रासायनिक सूत्र है

- रासायनिक प्रतिक्रिया द्वारा ही अलग किया जा सकता है
- रासायनिक का मतलब है, भौतिक रूप से नहीं

Mixtures

$H_2 + O \longrightarrow H_2O$

- A combination of two or more pure substances that are not chemically combined.
- substances held together by *physical forces, not chemical*
- No chemical change takes place
- Each item retains its properties in the mixture
- They can be separated physically



मिश्रण

- दो या दो से अधिक शुद्ध पदार्थों का संयोजन जो रासायनिक रूप से संयुक्त नहीं हैं।

- भौतिक बलों द्वारा एक साथ रखे गए पदार्थ, रासायनिक नहीं

कोई रासायनिक परिवर्तन नहीं होता है

- प्रत्येक आइटम अपने गुणों को बरकरार रखता है

- मिश्रण में उन्हें भौतिक रूप से अलग किया जा सकता है

2. Types of Mixtures

Mixtures can also be grouped

i) on the basis of their physical states:

	SOLID	LIQUID	GAS
SOLID	• Salt and sugar	• Salt and water	• Dust in air
LIQUID	• Mercury and copper	• Alcohol and water	• Clouds
GAS	• Hydrogen and palladium	• Oxygen and water	• Air

ii) on the basis of miscibility:

Homogeneous Mixture	Heterogeneous Mixture
• It consists of single phase. • Uniform composition. • Example: Sugar dissolved in water	• It consists of two or more phase. • Does not have uniform composition. • Example: Air, sand and common salt.

मिश्रण

मिश्रण वह अशुद्ध पदार्थ है जो दो या दो से अधिक शुद्ध पदार्थों (तत्व या यौगिक या दोनों) के किसी भी अनुपात में बिना रासायनिक संयोग के मिलने से बनता है तथा जिसके अवयवी पदार्थों को सरल यांत्रिक या भौतिक विधियों द्वारा अलग-अलग किया जा सकता है।

उदाहरण के लिए **वायु अनेक गैसों का मिश्रण है।** वायु में ऑक्सीजन, कार्बन डाइऑक्साइड, जलवाष्प प्रमुख हैं।

मिश्रण के प्रकार

मिश्रण के अवयव पदार्थों की प्रकृति तथा उनसे बने मिश्रण के गुण एवं संगठन के आधार पर इसे दो मुख्य प्रकारों में विभाजित किया जाता है।

1. समांगी मिश्रण

मिश्रण जिसके प्रत्येक भाग में उसके अवयवी पदार्थों का संगठन एवं गुण सामान रहता है समांगी मिश्रण कहलाता है। चीनी का जल में विलियन, नमक का जल में घोल, अमोनिया गैस का हवा में विलियन आदि इसके उदाहरण हैं।

2. असमांगी मिश्रण

वह मिश्रण जिस के विभिन्न भागों में उसके अवयवी पदार्थों का संगठन एवं गुण एक समान नहीं होते असमांगी मिश्रण कहलाता है। लोहा एवं गंधक, बालू एवं नमक , खड़िया का जल में, धूल कणों का हवा में मिश्रण आदि असमांगी मिश्रण के उदाहरण हैं। सामान्यतः एक असमांगी मिश्रण के अवयव पदार्थों को एक-दूसरे से अलग करना एक समांगी मिश्रण की तुलना में अधिक आसान होता है।

4. Separating the components of a mixture

The components of a heterogeneous mixture can be separated by

- ***simple methods like -***

  hand picking , sieving , & Winnowing

- ***special techniques like -***

  i) Evaporation : a mixture of salt and water or sugar and water.

  ii) Centrifugation : Butter from curd, Fine mud particles suspended in water.

  iii) Decantation (Using separating funnel) : Oil from water.

  iv) Sublimation : Camphor from salt,

  v) Chromatography : Different pigments from an extract of flower petals.

  vi) Distillation and fractional distillation : Separating components of Petroleum

  viii) Magnetic separation: Iron pins from sand.

Can you identify the following?

You will be shown a series of photos. Tell if each photo represents an item composed of an element, compound, or mixture.

Review:

- An **element** contains just one type of atom.
- A **compound** contains two or more different atoms joined together.
- A **mixture** contains two or more different substances that are only physically joined together, not chemically.
  - A mixture can contain both elements and compounds.

Element, Compound, or Mixture?

Rocks

Element, Compound, or Mixture?

Rocks

Element, Compound, or Mixture?

Copper

Element, Compound, or Mixture?

Copper

Cu

Element, Compound, or Mixture?

Jelly Beans

Element, Compound, or Mixture?

Jelly Beans

Element, Compound, or Mixture?

Table Sugar

Element, Compound, or Mixture?

Table Sugar

$C_{12}H_{22}O_{11}$

Element, Compound, or Mixture?

Diamond

Element, Compound, or Mixture?

C

Diamond

Element, Compound, or Mixture?

Tea

Element, Compound, or Mixture?

Tea

Element, Compound, or Mixture?

Salt

Element, Compound, or Mixture?

NaCl

Salt

Element, Compound, or Mixture?

Neon Gas

Element, Compound, or Mixture?

Ne

Neon Gas

Element, Compound, or Mixture?

Salad

Element, Compound, or Mixture?

Salad

Element, Compound, or Mixture?

Pure Water

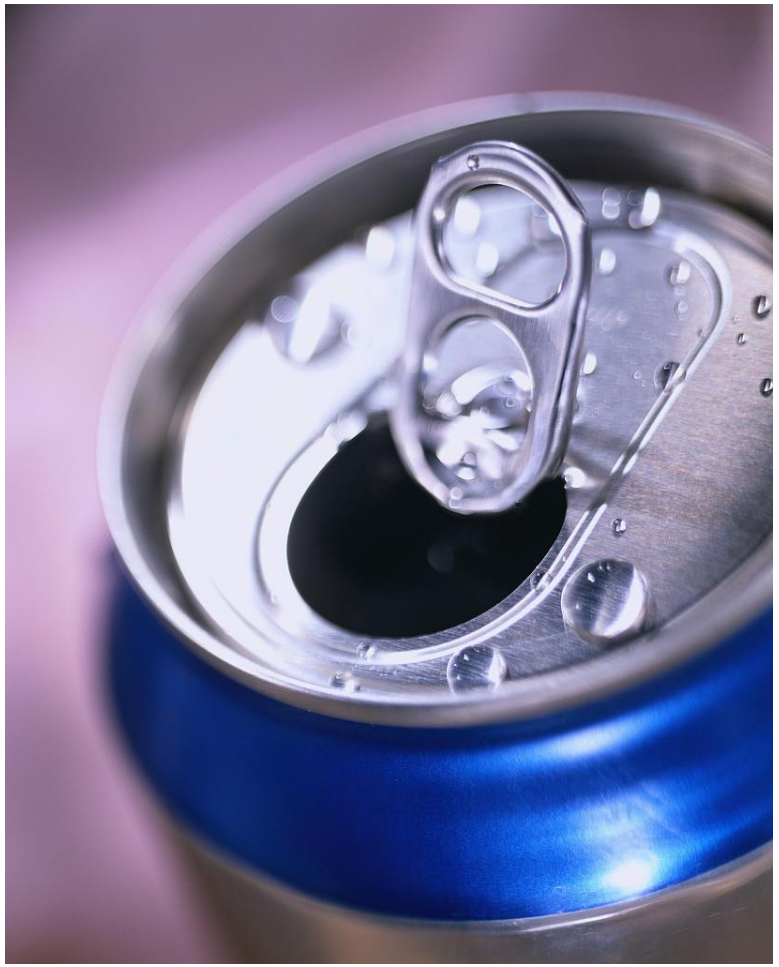
Element, Compound, or Mixture?

Pure Water

H_2O

Element, Compound, or Mixture?

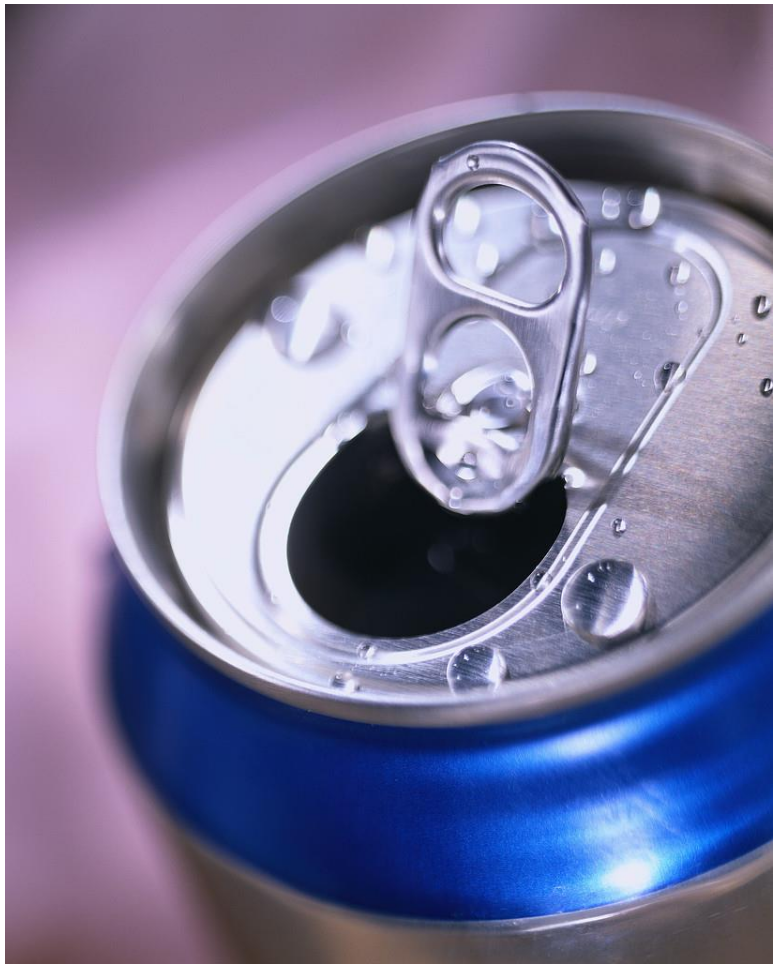
Aluminum



Element, Compound, or Mixture?

Aluminum

Al



Element, Compound, or Mixture?

Lemonade

Element, Compound, or Mixture?

Lemonade

Element, Compound, or Mixture?

Silver

Element, Compound, or Mixture?

Silver

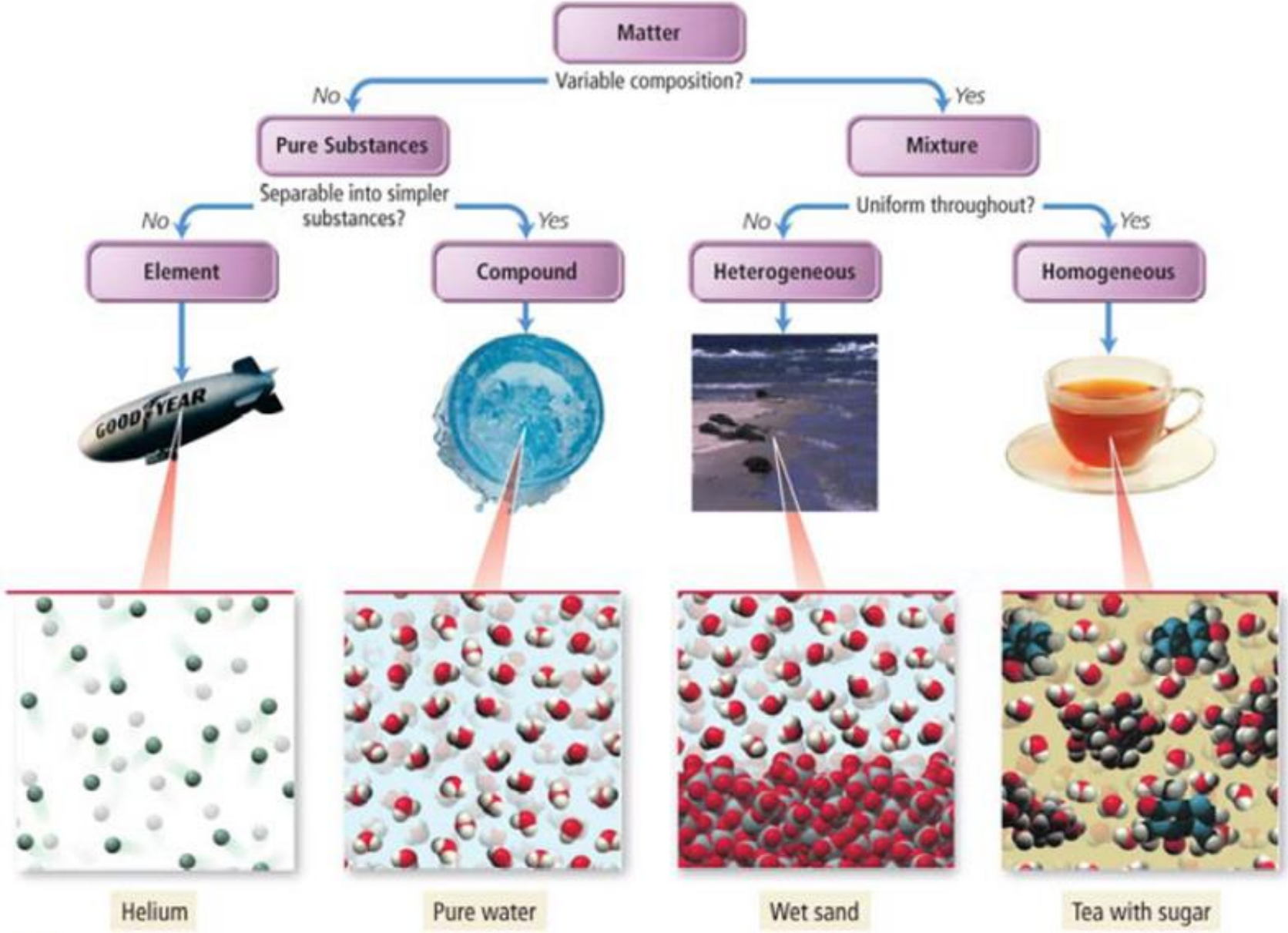
Ag

Element, Compound, or Mixture?

Sand

Element, Compound, or Mixture?

Sand



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MATTER

Is it uniform throughout?

- No → **Heterogeneous mixture**
- Yes → **Homogeneous**

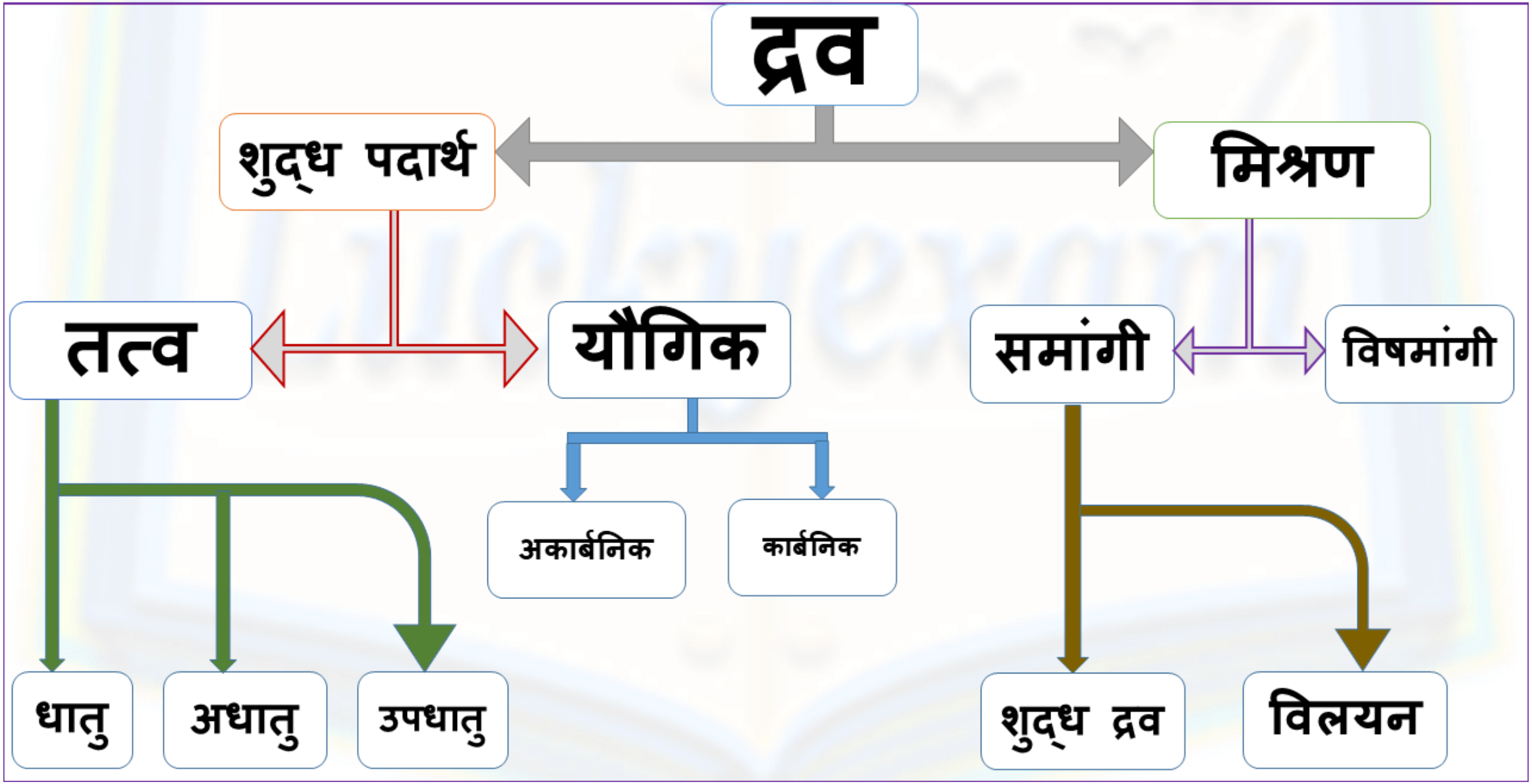
Can it be separated by physical means?

- No → **Pure Substance**
- yes → **Homogeneous Mixture (solution)**

Can it be decomposed into other substance by a chemical process?

- No → **Element**
- yes → **Compound**

द्रव्य का वर्गीकरण (Classification of Matter) Chart



classes of MIXTURES

	Solution	Colloid	Suspension
Examples	salt water, air	Soot, fog, mayonnaise	Muddy water, Italian dressing
Particle Type	ions, atoms	Small Clusters	Large Clusters
Particle Size	small	medium	large
Scatter Light? **(TYNDALL EFFECT)**	No	yes	yes
Settle while standing?	No	No	yes
Separate by filtration?	No	No	yes

Homogeneus mixtures

Homogeneous mixtures : is a mixture in which the components are evenly distributed among each other.
You can't see the component parts.
Homo means the same throughout.
It has a constant composition throughout.

- **Homogenous mixtures are also called SOLUTIONS**

C Copper(II) sulfate ($CuSO_4$) in water, a homogeneous mixture (solution)

Examples: Salt dissolved in water, sugar dissolved in water, apple juice, tea, copper (II) sulfate solution in water, alloys....

Solutions

- Well-mixed (uniform) – single phase
- homogeneous
- transparent
- cannot be separated by filter
- do not separate on standing

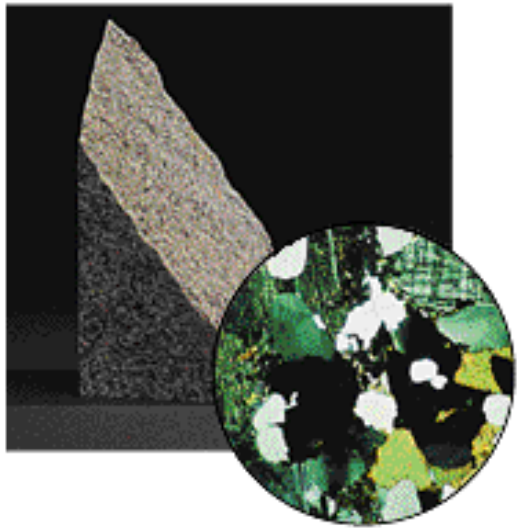
States of matter in solution	Example of solutions
gas in gas	air (N_2, O_2 , Ar, CO_2 , other gases)
gas in liquid	soda pop (CO_2 in water)
liquid in liquid	gasoline (a mixture of hydrocarbon compounds)
solid in liquid	Filtrated sea water (NaCl and other salts in water)
gas in solid	H_2 in platinum or palladium
liquid in solid	dental amalgams (mercury in silver)
solid in solid	alloys (brass, (Cu/Zn), solder (Sn/Pb), Steel (Fe/C))

heterogeneous mixtures

Heterogeneous mixture : the components are not evenly distributed among each other. An heterogeneous mixture has two or more distinct phases that are usually detectable. This type of mixture does NOT have uniform properties.

Heterogeneous mixtures that look like solutions can be distinguished because they scatter light (Tyndall effect).

Examples: Sand water, oil and water, milk, sulfur and iron, granite, blood...



A Granite, a heterogeneous mixture

B Human blood, a heterogeneous mixture

कोलाइडल विलयन

- समांगी (Homogeneous) तथा विषमांगी (Heterogeneous mixture) मिश्रणों के बीच के गुण वाला एक मिश्रण जिसके कण विलयन में समान रूप से फैले होते हैं, कोलाइडल विलयन कहलाते है

कोलाइड के गुण (Properties of a Colloid)

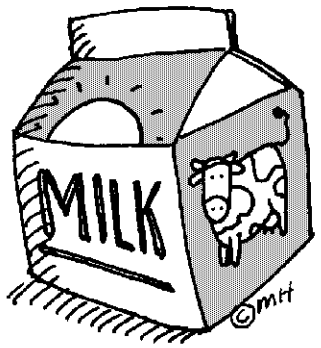
- कोलाइड एक विषमांगी (Heterogeneous)मिश्रण है.

- कोलाइड के कण इतने बड़े होते हैं कि वे प्रकाश को फैला देते हैं, जिससे प्रकाश का मार्ग दृष्टिगोचर हो जाता है.

- कोलाइडी विलयन को शांत छोड़ देने पर इसके कण तल पर नहीं बैठते हैं, अर्थात ये स्थाई होते हैं.

- कोलाइड के कणों को छानन विधि द्वारा पृथक नहीं किया जा सकता परंतु एक विशेष विधि अपकेन्द्रीकरण तकनीक (Centrifugal technique) द्वारा इन्हें पृथक किया जा सकता है.

Colloids



non transparent, non uniform, large particles, cloudy (milky)

but stable system

Suspensions

- A suspension of liquid droplets or fine solid particles in a gas is called an aerosol. In the atmosphere these consist of fine dust and soot particles, and cloud droplets.

- suspension: system does not stays stable and settle

- Examples of Suspensions
  - Mud or muddy water, is where soil, clay, or silt particles are suspended in water.
  - Flour suspended in water.
  - Paint
  - Chalk powder suspended in water.
  - Dust particles suspended in air.
  - Algae in water
  - Milk of Magnesia

Tyndall effect:

You can see the light passes through a colloid or suspension. (particles scatter light.)

emulsion: a mixture of immiscible substances (liquid-liquid).
like milk and mayonnaise

[Which of the following will show the Tyndall Effect]

A. [water]

B. [sugar water]

C. [oxygen gas]

D. [fog]

[Which of the following is a colloid]

A. [milk]
B. [NaCl in water]
C. [sand and water]
D. [raisin bread]

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