AN OVERVIEW TO GENERAL CHEMISTRY

Session 1

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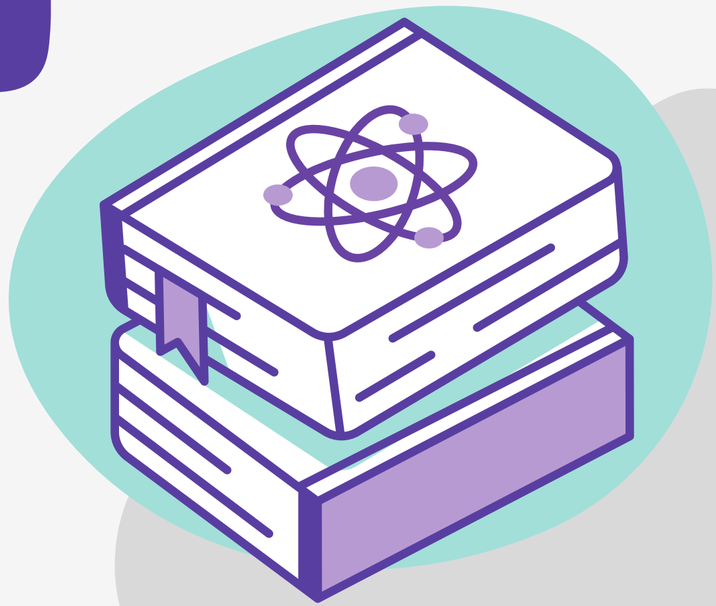


Learning Targets

1. Classify matter according to their state, composition, properties and changes that matter undergoes;
2. Explain the states and transformation of matter that occurs during heat transfer;
3. Differentiate intensive and extensive properties of matter;
4. Recognize physical and chemical change;
5. Discuss endothermic and exothermic reactions;
6. Recall the SI prefixes and their meaning, and
7. Express numbers into scientific notations.

Chemistry

- is the study of matter and how we can change matter chemically and physically;
- science that deals with the properties, composition, structure, and changes that matter undergoes
- “central science”
- “Physical Science”
- “ABC of Pharmacy Practice

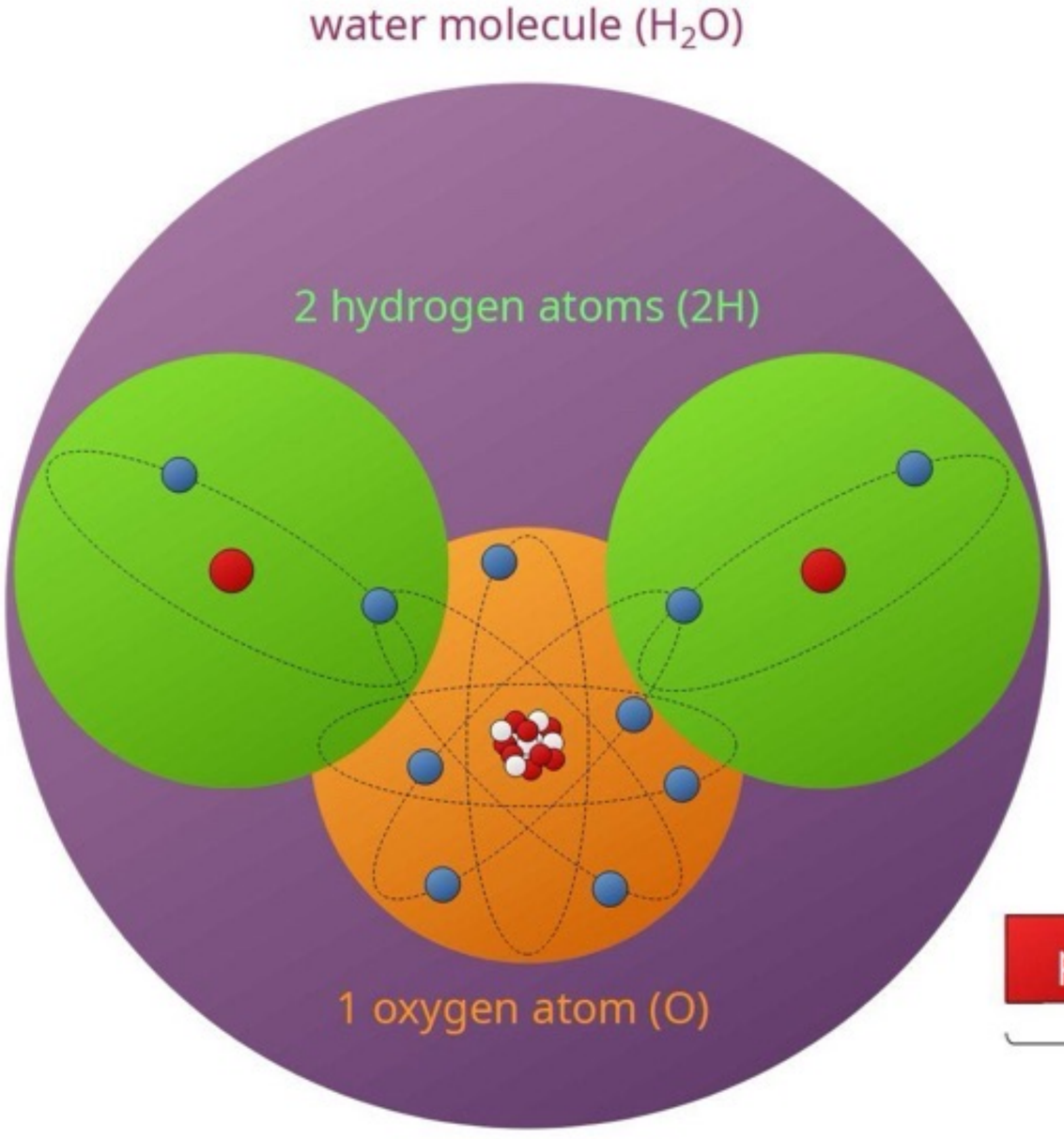
Matter

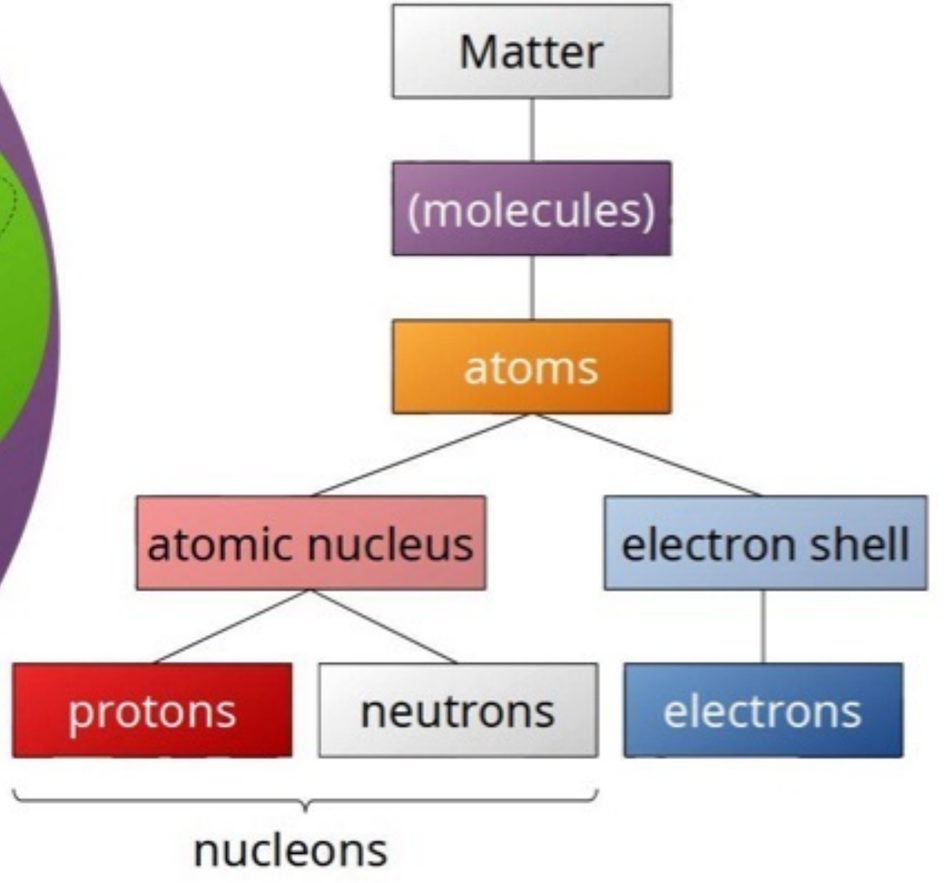
- Anything that occupies space and has mass.
- Made up of “small indivisible particles” called atoms.
- Composed of atoms, molecules, ions, and any other particles.

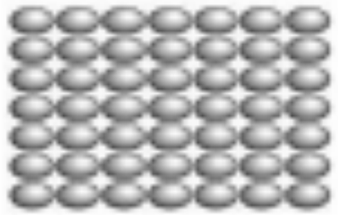
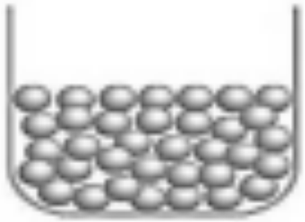
Classification of Matter

I.A. According to Physical State (4Types)

- Solid
- Liquid
- Gas
- Liquid Crystals


water molecule (H_2O)
2 hydrogen atoms (2H)
1 oxygen atom (O)


Matter
(molecules)
atoms
atomic nucleus
electron shell
protons
neutrons
electrons
nucleons

	SOLIDS	LIQUIDS	GASES	LIQUID CRYSTALS
				
Shape	Definite	Indefinite	Indefinite	aka "PLASMA" and "MESOPHASE" Intermediate properties between solids and liquid *Solid: It has lattice structure* *Liquid: It possess flow properties*
Volume	Definite	Definite	Indefinite	
Strength	Strong intermolecular forces of attraction	Intermediate force of attraction	Weak forces of attraction	
Molecular motion	Vibrational motion	Gliding motion	Random and constant molecular motion	
Others	Lattice structure	Possess flow properties	Greater expansion and compressibility	

Classification of Matter

I.B. According to Composition/Constituents

1. Pure Substances

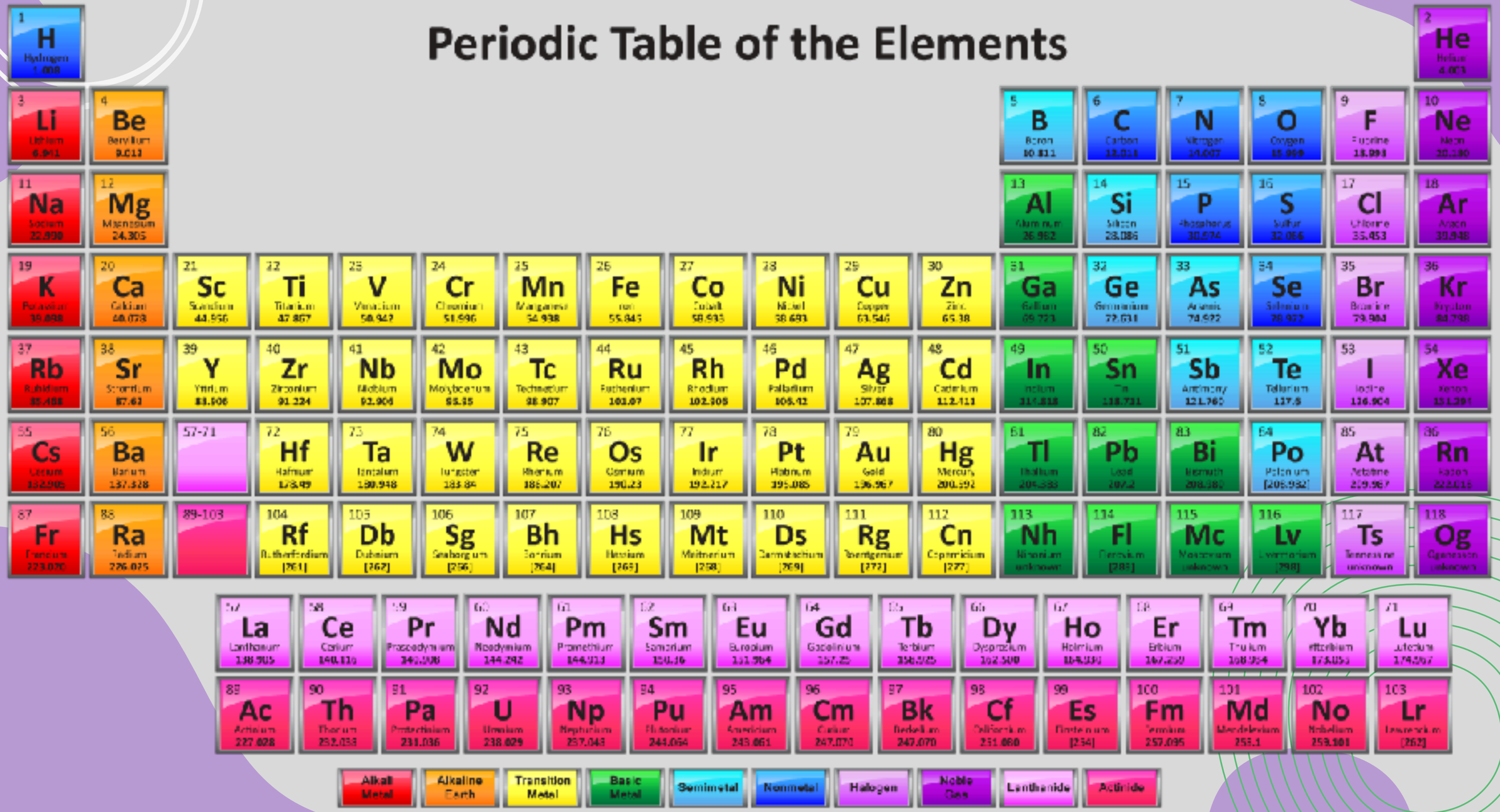
Matter that has a definite or constant composition and distinct properties.

1. Pure Substances

a. Element

- simplest form of matter that consists of one kind of atom
- has definite chemical composition
- cannot be decomposed by simple physical/ chemical means into two or more different substances

Periodic Table of the Elements



1. Pure Substances

b. Compound

- substance composed of two or more elements unites chemically in definite proportion
- cannot be changed into simpler substance under normal laboratory conditions

Water

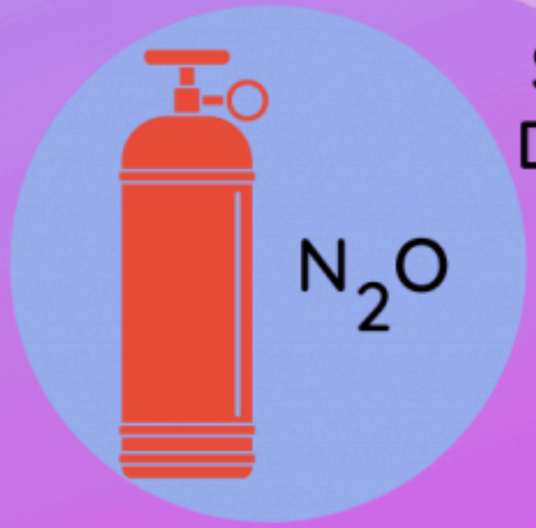
NaCl

Salt

SiO_2

Silicon Dioxide

Hydrochloric Acid



N_2O

Nitrous Oxide

1. Pure Substances

“Law of Definite Proportions”

- Elements combined in fixed ratios of whole numbers to form compounds
- aka **“Proust Law”**, states that the elemental composition of a pure compound is always the same regardless
- for Inorganic compounds

1. Pure Substances

“Law of Multiple Proportions”

- Elements combined in different ratios of whole numbers to form different compounds
- for Organic compounds

2. Mixture

composed of two or more elements/ substances which are not chemically combined

2. Mixture

a. **Heterogeneous mixture**

- two or more distinct phases

2. Mixture

Suspension

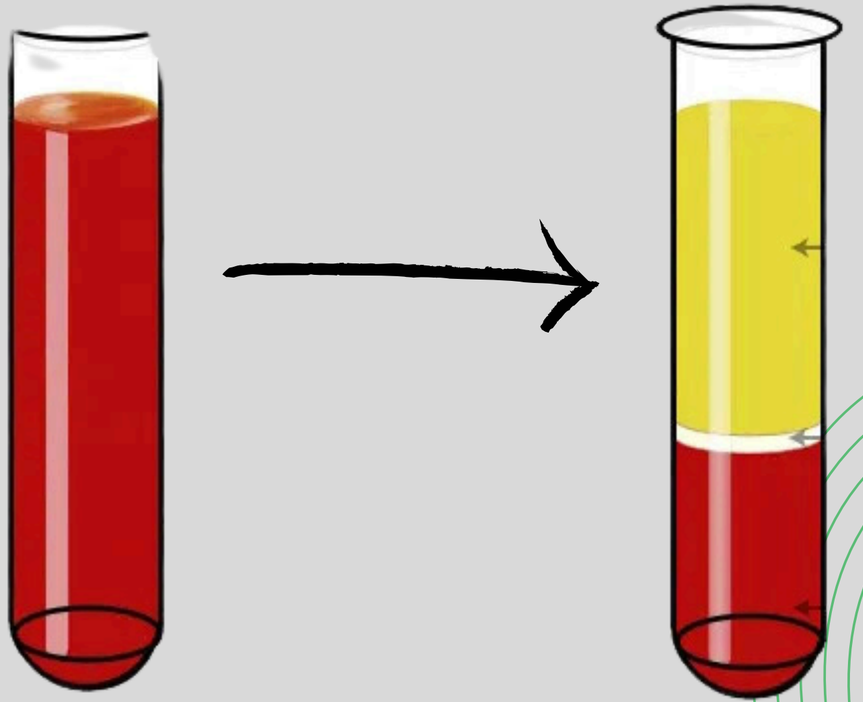
- homogenous dispersion insoluble in a liquid
- aka Coarse Mixture
- finely divided solid materials distributed in a liquid

2. Mixture

Colloids

- contain particles bigger than those in solutions but smaller than those in suspension
- Particle of solute is not broken down to the size of the molecules but are small dispersed throughout the medium
- exhibit the light scattering effect

2. Mixture

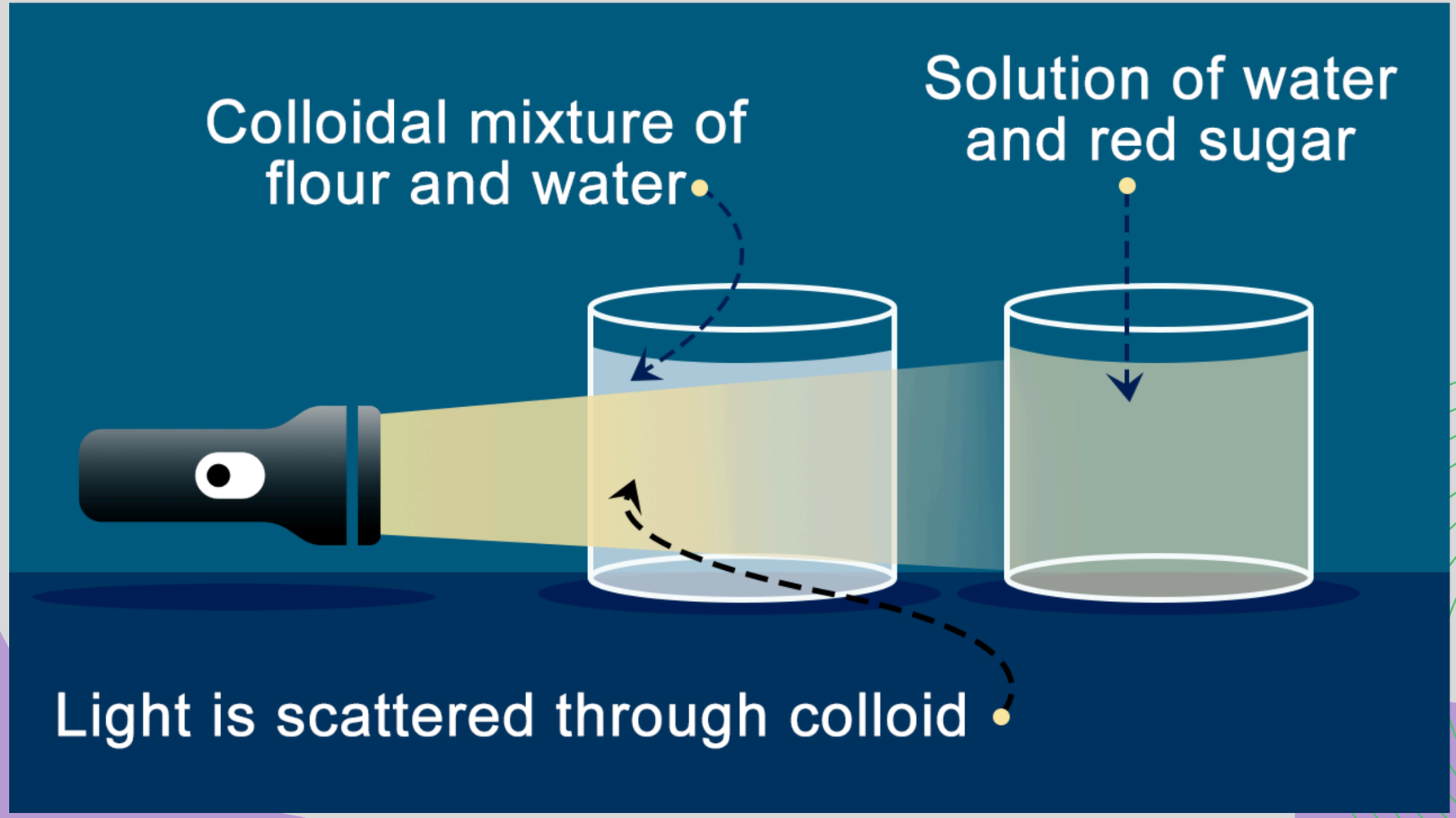


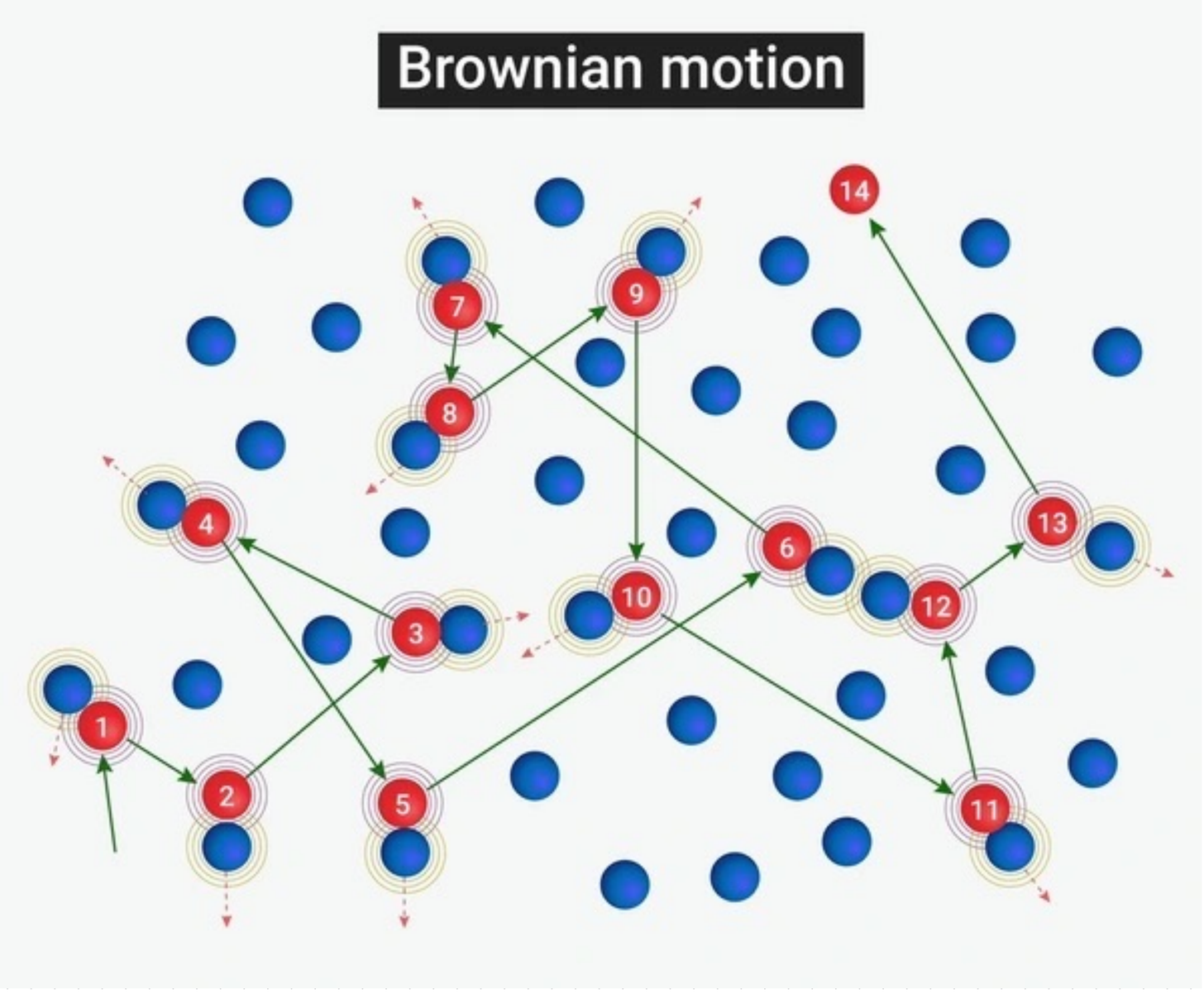
2. Mixture

Properties of Colloids (TBAC)

1. _____
   - aka light scattering
2. _____
   - continuous zigzag movement of colloidal particles due to perfectly elastic collision
3. _____
4. _____
   - used in gel electrophoresis

2. Mixture


Colloidal mixture of flour and water
Solution of water and red sugar
Light is scattered through colloid


Brownian motion
1
2
3
4
5
6
7
8
9
10
11
12
13
14

2. Mixture

b. Homogeneous mixture

- only one phase or single phase

2. Mixture

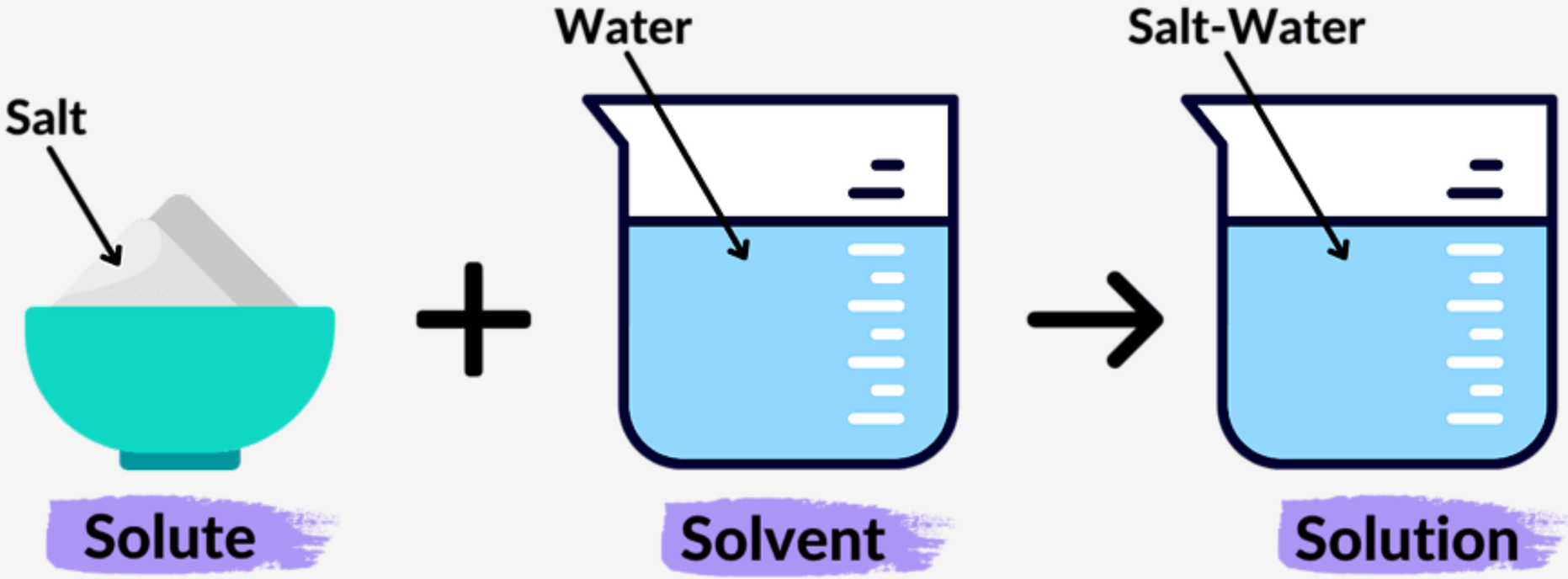
Solution

- uniform mixture; composed of solute & solvent

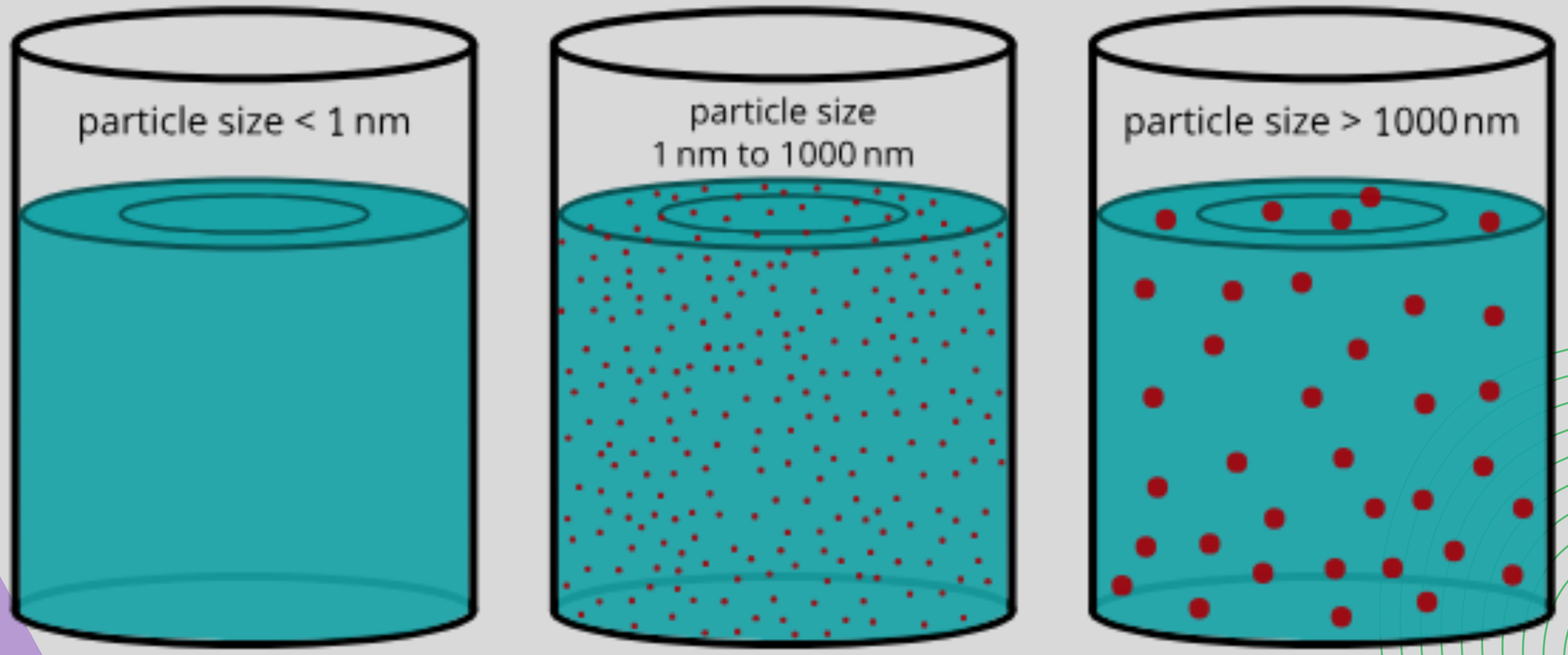
Parts of Solution

- **Solute**
  - The part of solution that is being dissolved
- **Solvent**
  - The part of the solution that dissolves the solute

2. Mixture



2. Mixture



Solution Colloid Suspension

PROPERTIES OF MATTER

Physical property:

- can be measured and observed without changing the composition or identity of a substance

Ex: Temperature, length, color, melting point, boiling point, solubility, malleability, ductility, hardness

PROPERTIES OF MATTER

Also, physical properties are either intensive or extensive.

- **Extrinsic/extensive:** depends on the amount of matter being considered Ex: weight, volume, pressure, heat content, hardness
- **Intrinsic/intensive:** do not depend on the amount of matter being considered Ex: temperature, density, specific gravity, melting point

Note: It is also the ratio of two extrinsic or extensive property (Ex: weight/volume = DENSITY)

PROPERTIES OF MATTER

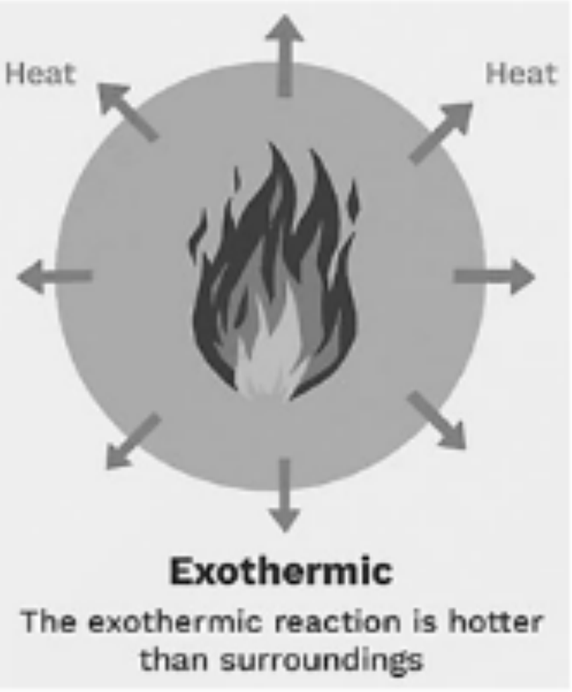
Chemical property

- can be determined only by changing the composition or identity of a substance

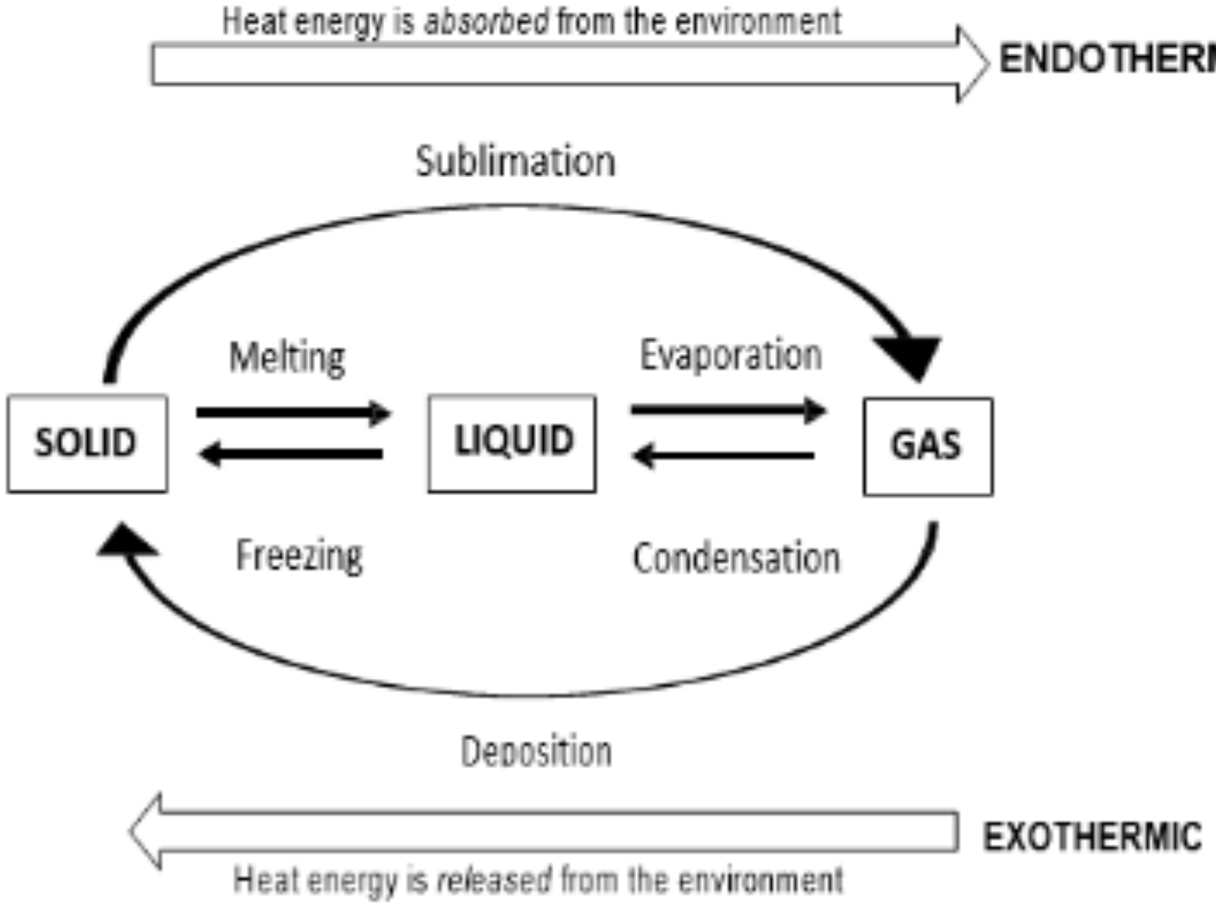
Ex: Flammability, reactivity, inertness, chemical stability

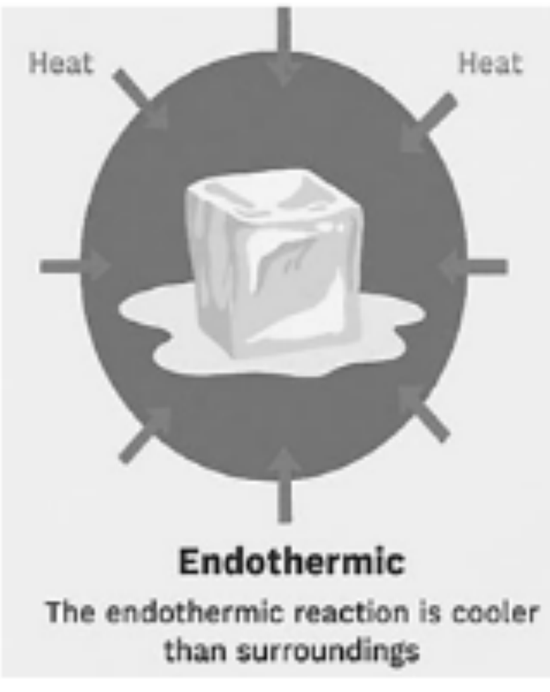
CHANGES THAT MATTER UNDERGOES

1. Physical Change – Changes that alter only state or appearance but not composition



Helmenstine A.M., (Sep 2019). *Understanding Endothermic and Exothermic reactions*. Retrieved from https://www.thoughtco.com/





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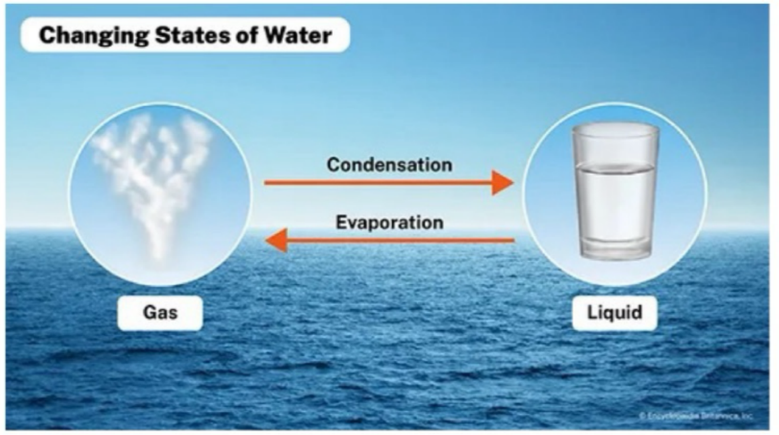

Changing States of Water
Condensation
Evaporation
Gas
Liquid

CHANGES THAT MATTER UNDERGOES

2. Chemical Change – changes that alter the composition of matter wherein atoms rearrange transforming the original substances into different substances

CHANGES THAT MATTER UNDERGOES

Evidences of Chemical Change:

a. Evolution of gas

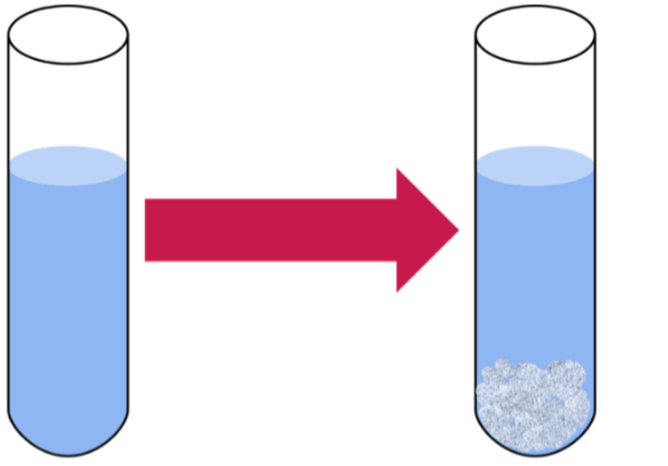
b. Formation of precipitate

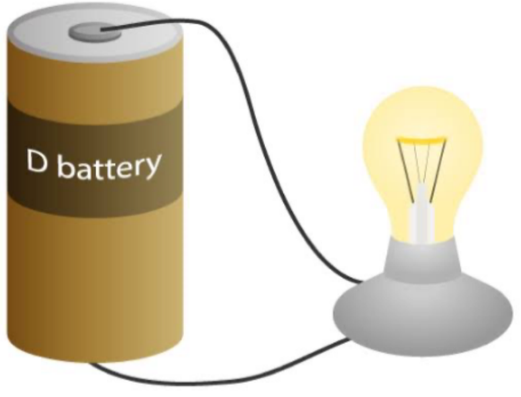
c. Emission of light

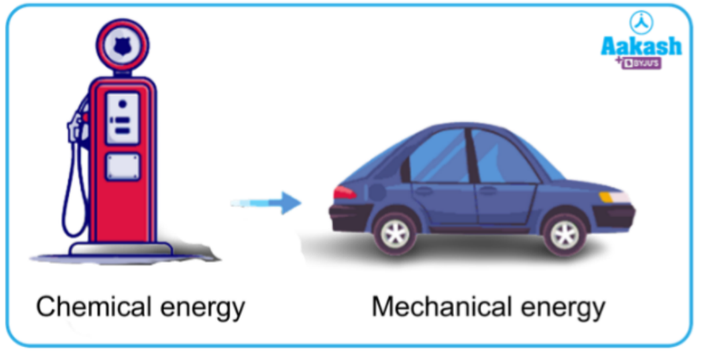
d. Generation of electricity

e. Production of mechanical energy

f. Absorption/liberation of heat


Solution
Precipitation


D battery

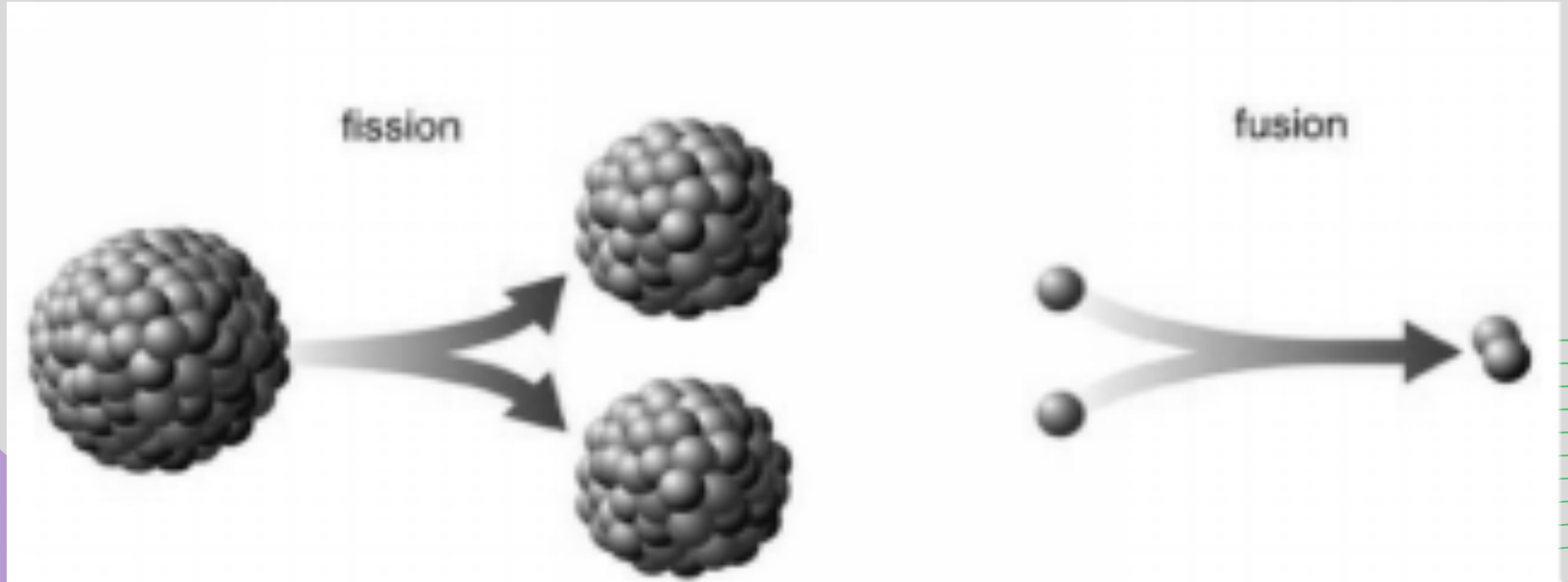

Aakash
Chemical energy
Mechanical energy

CHANGES THAT MATTER UNDERGOES

3. Nuclear Change - chance in the structure of properties, composition of the nucleus of an atom resulting in the transmutation of the element into another element

- **Nuclear Fission:** Splitting of a heavy atom
- **Nuclear Fusion:** Union of 2 light atoms to form a bigger molecule

CHANGES THAT MATTER UNDERGOES



Wesley A., (2004). *Fission vs. Fusion – What is the Difference?* Pearson Education. Retrieved from Duke Energy at https://nuclear.duke-energy.com/

Measurement

The study of chemistry depends heavily on measurement. For instance, chemists use measurements to compare the properties of different substances and to assess changes resulting from an experiment.

- **Mass** refers to the amount of matter present in the material
- **Weight** = Mass x pull of gravity

Measurement

International System of Units

Table 1.2 SI Base Units

Base Quantity	Name of Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electrical current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

Table 1.3 Prefixes Used with SI Units

Prefix	Symbol	Meaning	Example
tera-	T	1,000,000,000,000, or 10^{12}	1 terameter (Tm) = 1×10^{12} m
giga-	G	1,000,000,000, or 10^{9}	1 gigameter (Gm) = 1×10^{9} m
mega-	M	1,000,000, or 10^{6}	1 megameter (Mm) = 1×10^{6} m
kilo-	k	1,000, or 10^{3}	1 kilometer (km) = 1×10^{3} m
deci-	d	1/10, or 10^{-1}	1 decimeter (dm) = 0.1 m
centi-	c	1/100, or 10^{-2}	1 centimeter (cm) = 0.01 m
milli-	m	1/1,000, or 10^{-3}	1 millimeter (mm) = 0.001 m
micro-	μ	1/1,000,000, or 10^{-6}	1 micrometer (μm) = 1×10^{-6} m
nano-	n	1/1,000,000,000, or 10^{-9}	1 nanometer (nm) = 1×10^{-9} m
pico-	p	1/1,000,000,000,000, or 10^{-12}	1 picometer (pm) = 1×10^{-12} m

Handling of Numbers

We now turn to techniques for handling numbers associated with measurements, these are scientific figures and scientific notation.

Handling of Numbers

1. SIGNIFICANT FIGURES

1. All nonzero digits are significant

Ex: 181 =

18 =

2. Zeros between nonzero digits are significant

Ex: 2014 =

1.004 =

7.206 =

Handling of Numbers

3. Zeros after a significant digit and after a decimal point are significant

Ex: 41.30 .

295.00

4. Zeros to the left of nonzero digits are not significant but are used to indicate the position of the decimal point

Ex: 0.003

0.023

5. When a number ends in zeros, the zeros are not significant unless they appear to the right of a decimal point (refer to rule #3)

Ex: 4 200

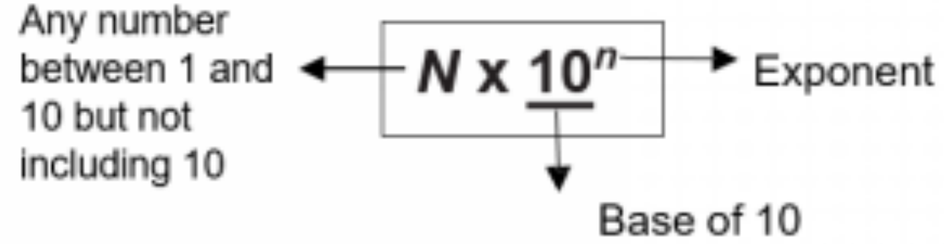
1 530

Handling of Numbers

- **SCIENTIFIC NOTATION** – used by scientist/chemist for convenience in calculation especially when dealing with very small and large numbers.

If *n* is a positive integer, move the decimal to the right.
If *n* is a negative integer, move the decimal to the left.

Formula



Handling of Numbers

Example: Express 45 000 in scientific notation

Step 1: Put the decimal after the first significant number

4.5000

Step 2: Add the “x 10” to the number

4.5 x 10^exponent

Step 3: To find the exponent, count the number of places from the decimal point to the end of the number

4.5000 (4 decimal places

Handling of Numbers

Step 4: Put the exponent to where it belongs and get rid of the zeros

4.5 x 104

9, 562 157 = 9.5 x 10^6

0.000015 = 1.5 x 10^-5

0.000251 = 2.51 x 10^-4

Handling of Numbers

Step 4: Put the exponent to where it belongs and get rid of the zeros

4.5 x 104

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