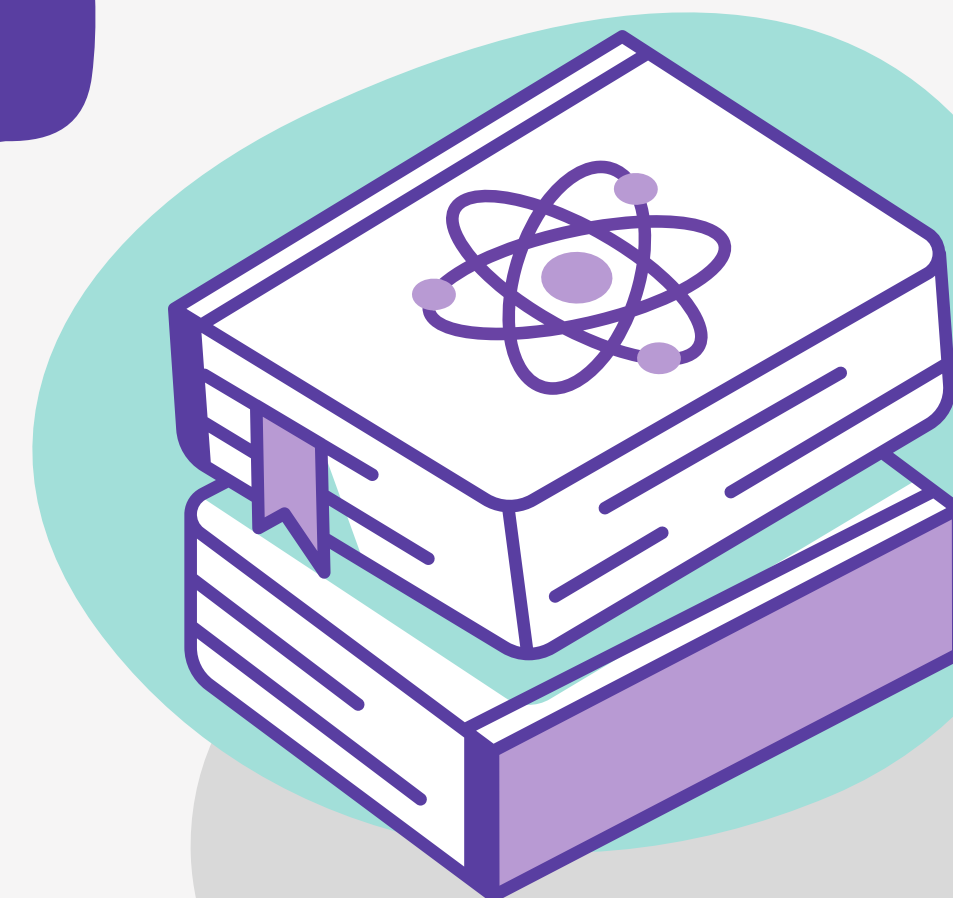


AN OVERVIEW TO GENERAL CHEMISTRY

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

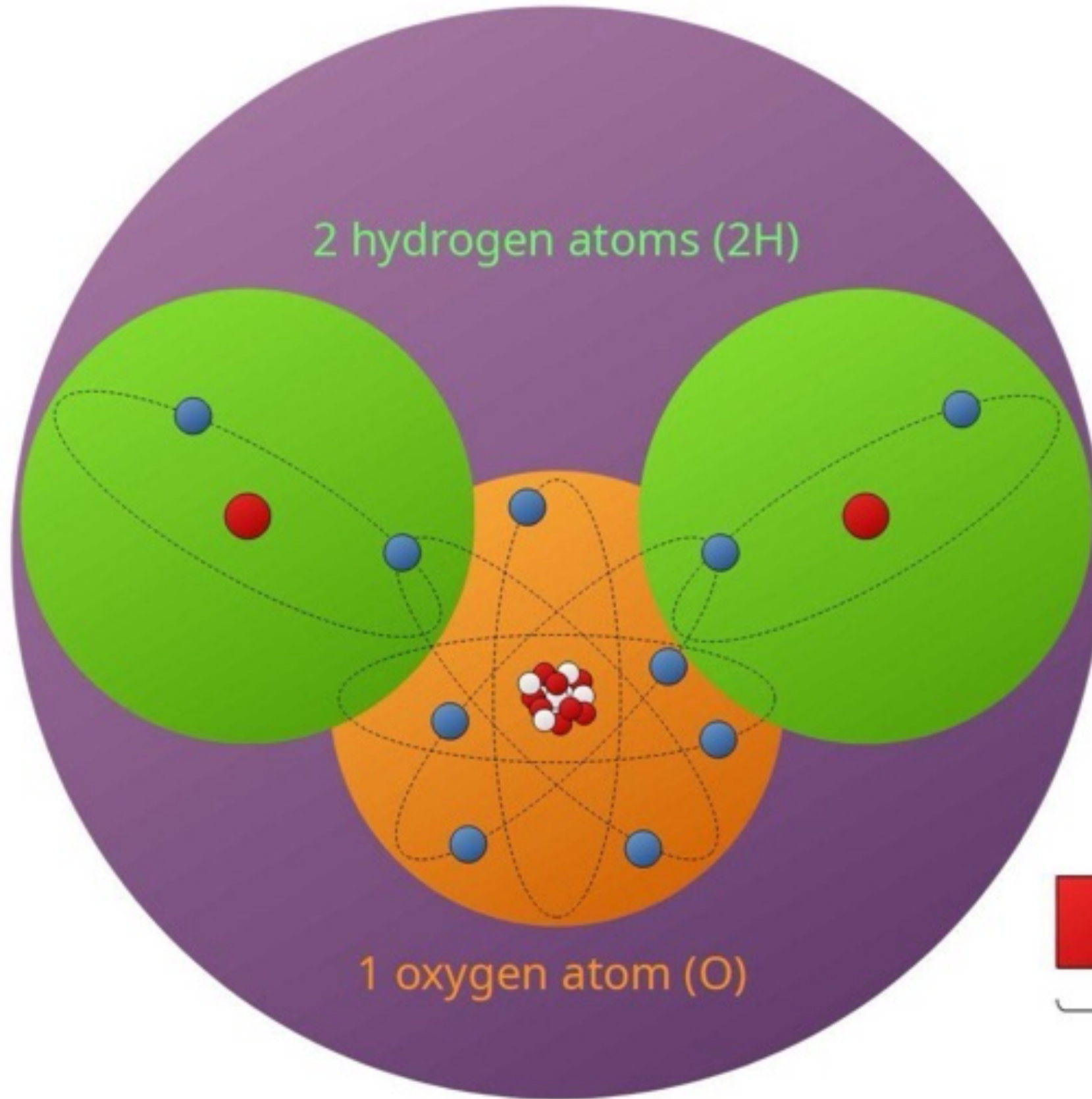
I.A. According to Physical State (4Types)

- Solid
- Liquid
- Gas
- Liquid Crystals

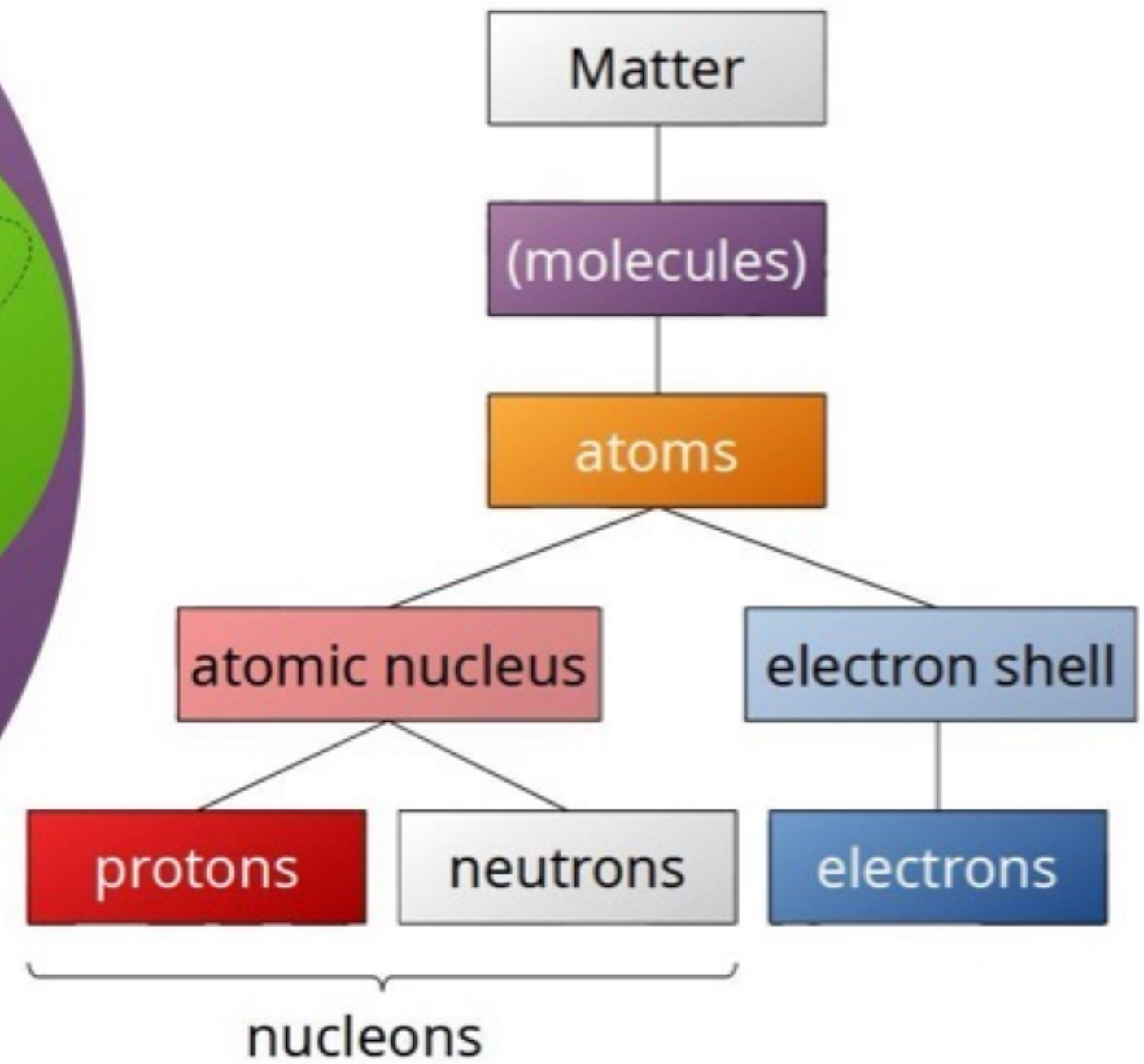
water molecule (H_2O)

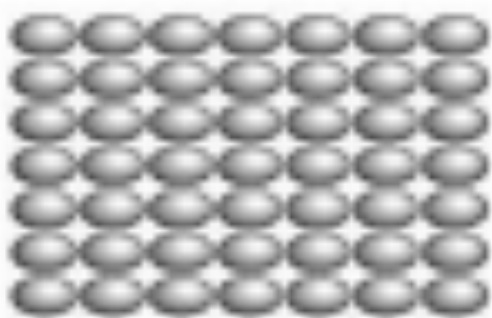
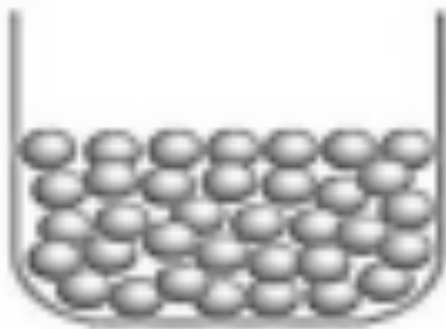


2 hydrogen atoms (2H)



1 oxygen atom (O)



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

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

Periodic Table of the Elements																					
1 H Hydrogen 1.008																	2 He Helium 4.003				
3 Li Lithium 6.941	4 Be Beryllium 9.012															5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305															13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.611	33 As Arsenic 74.922	34 Se Selenium 78.972	35 Br Bromine 79.904	36 Kr Krypton 83.798				
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.905	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.296				
55 Cs Cesium 132.905	56 Ba Barium 137.328	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.222	78 Pt Platinum 195.084	79 Au Gold 196.967	80 Hg Mercury 200.592	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [209]	85 At Astatine 210	86 Rn Radon 222				
87 Fr Francium 223	88 Ra Radium 226	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [265]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Nh Nihonium [284]	114 Fl Flerovium [285]	115 Mc Moscovium [288]	116 Lv Livermorium [293]	117 Ts Tennessine [294]	118 Og Oganesson [294]				

57 La Lanthanum 138.905	58 Ce Cerium 140.12	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.242	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.500	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.934	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.967
89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [252]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.108	103 Lr Lawrencium [262]

Alkali Metal	Alkaline Earth	Transition Metal	Basic Metal	Semimetal	Nonmetal	Halogen	Noble Gas	Lanthanide	Actinide
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1. Pure Substances

b. Compound

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



Water



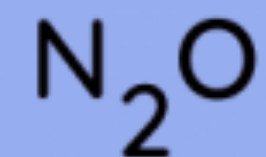
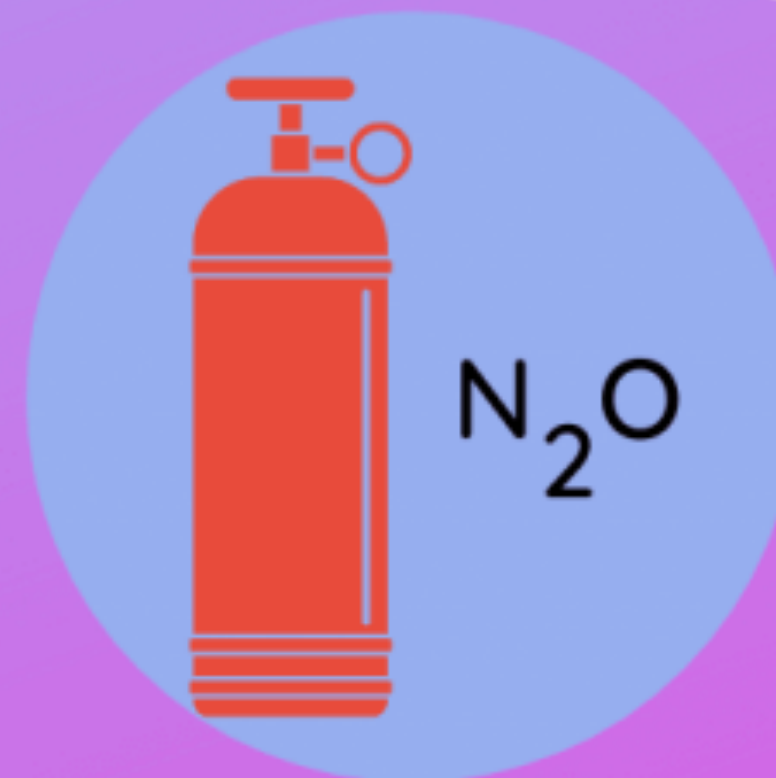
Salt



Silicon
Dioxide



Hydrochloric Acid



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

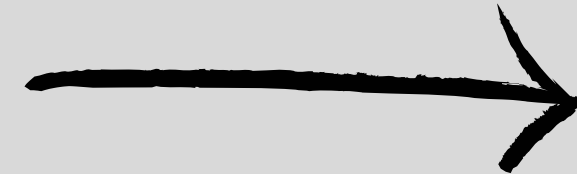


2. Mixture

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

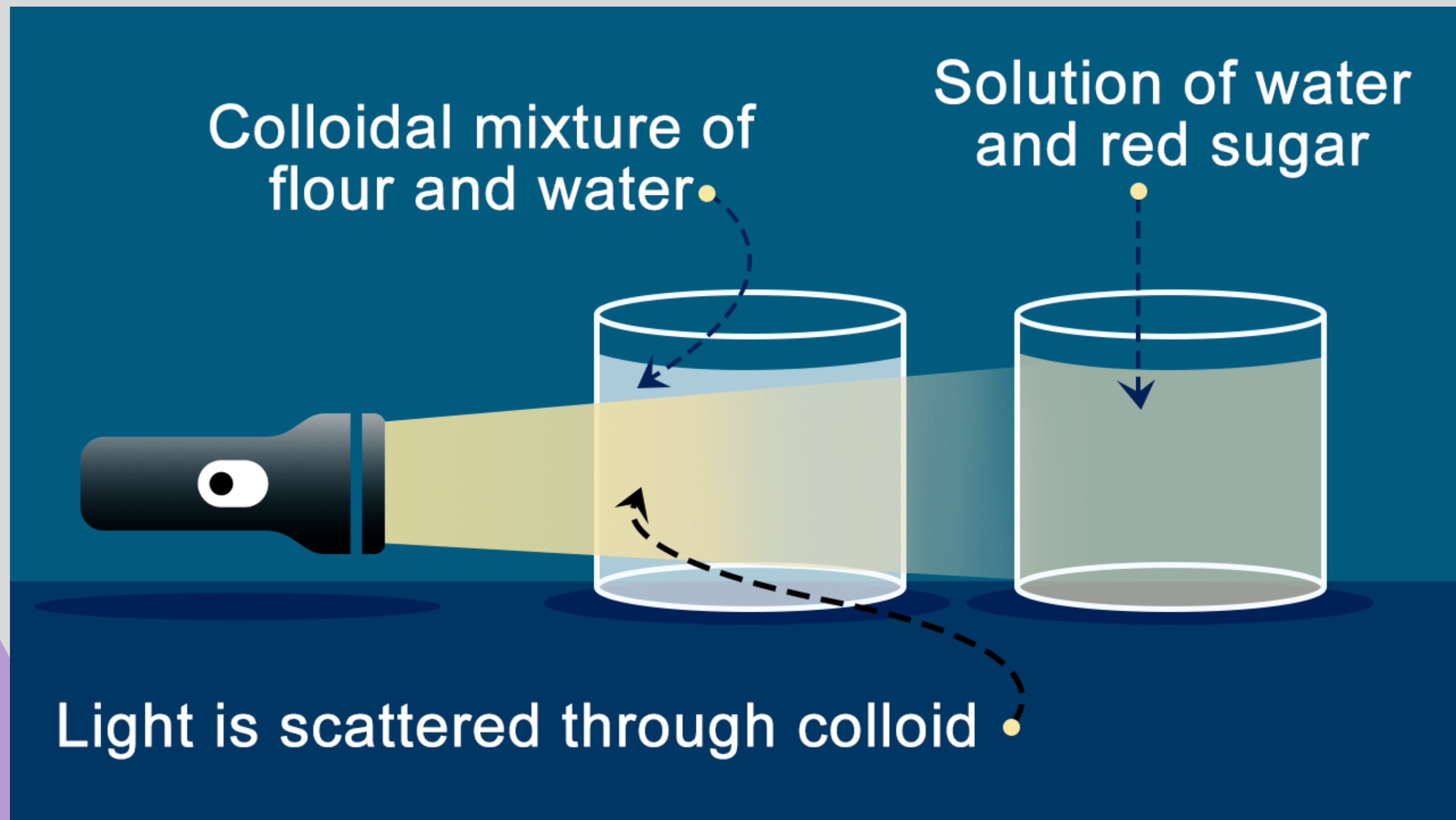


2. Mixture

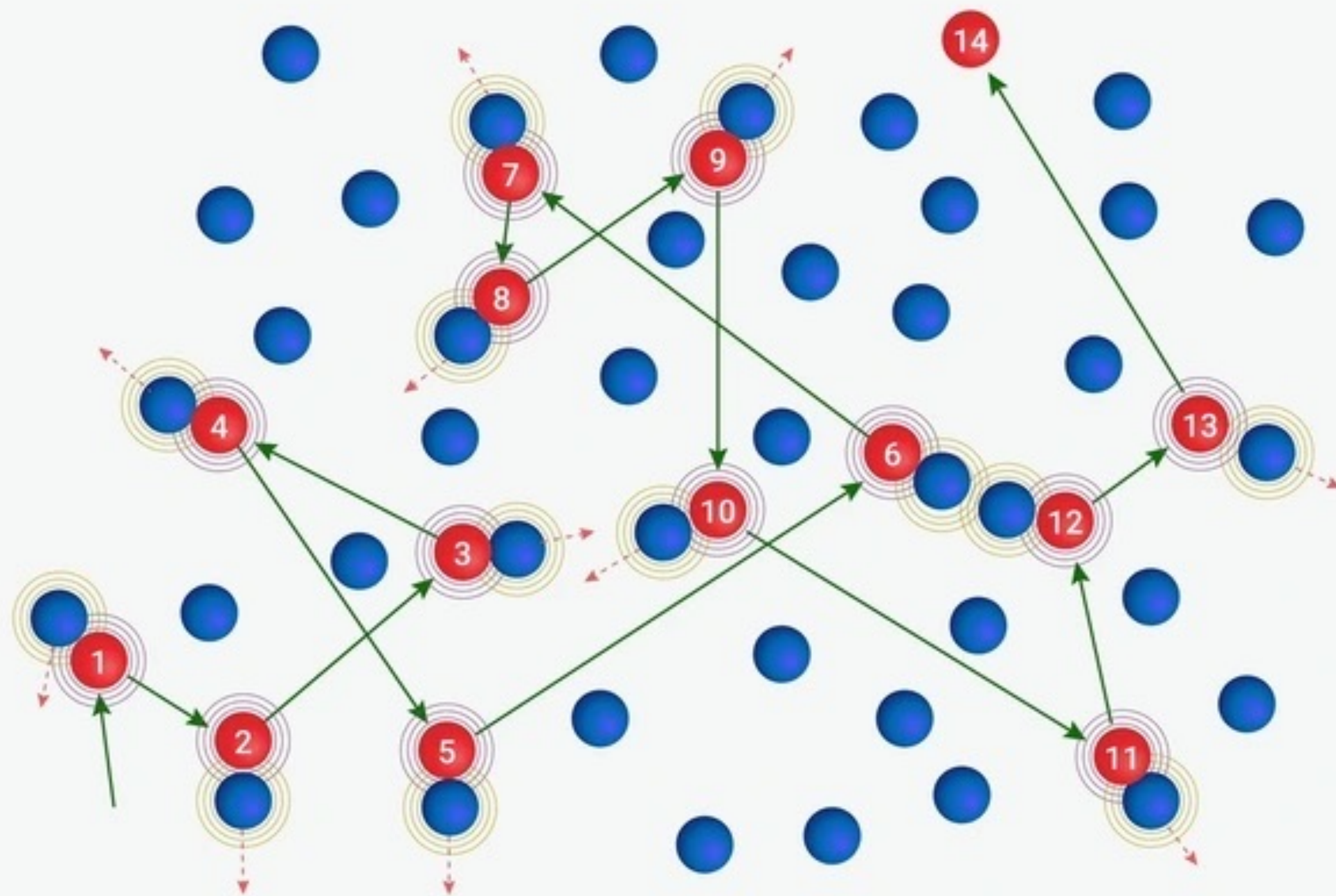
Properties of Colloids (TBAC)

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

2. Mixture



Brownian motion



2. Mixture

b. Homogeneous mixture

- only one phase or single phase

2. Mixture

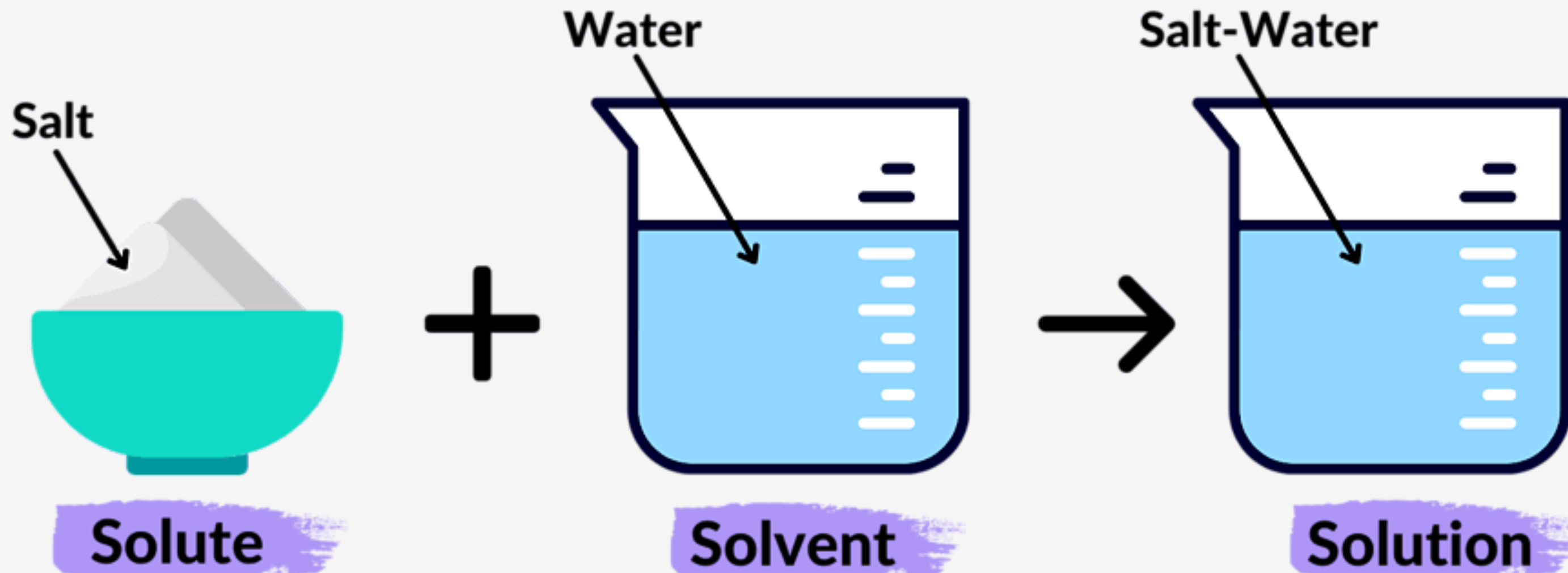
Solution

- uniform mixture; composed of solute & solvent

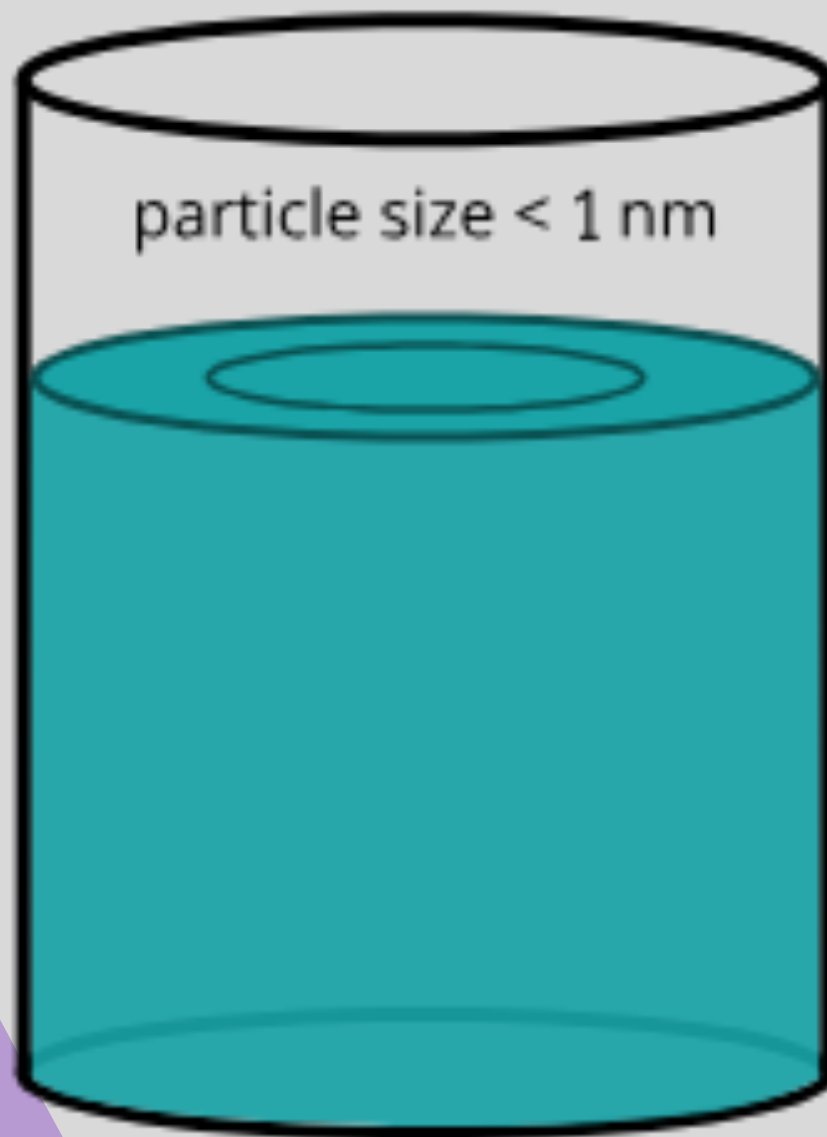
Parts of Solution

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

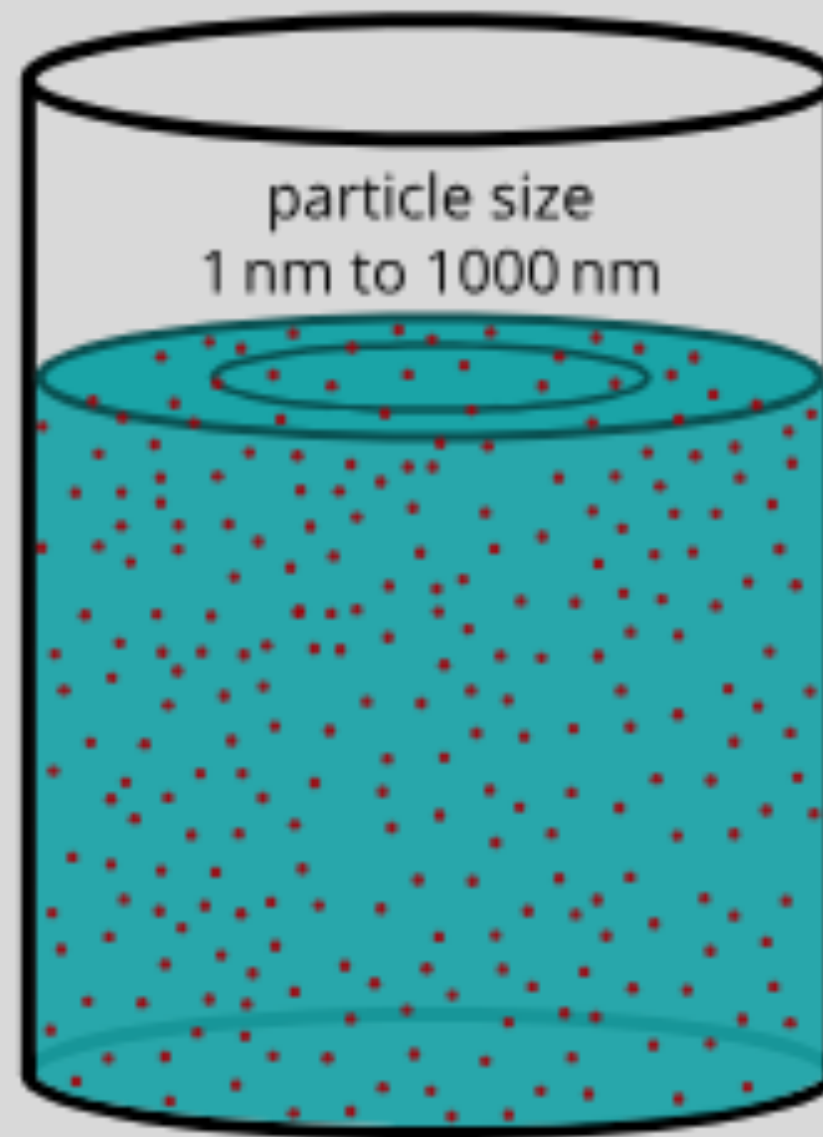
2. Mixture



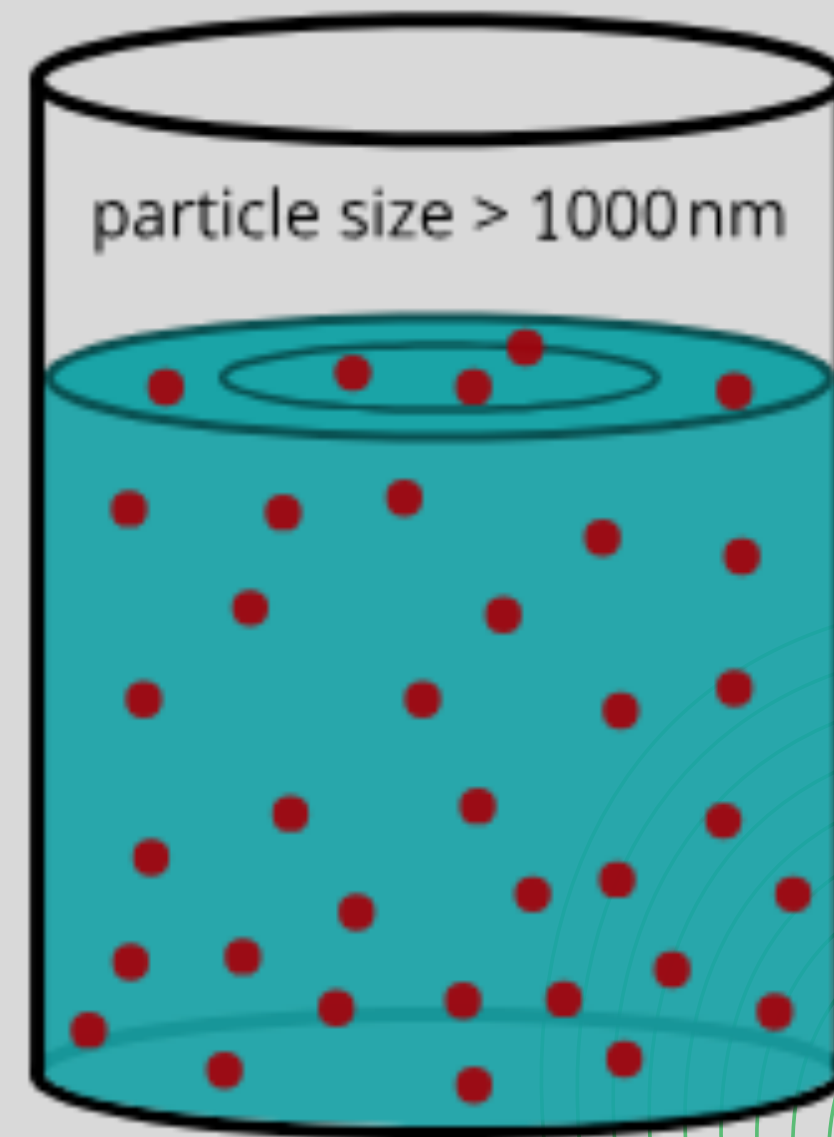
2. Mixture



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: $\text{weight/volume} = \text{DENSITY}$)

PROPERTIES OF MATTER

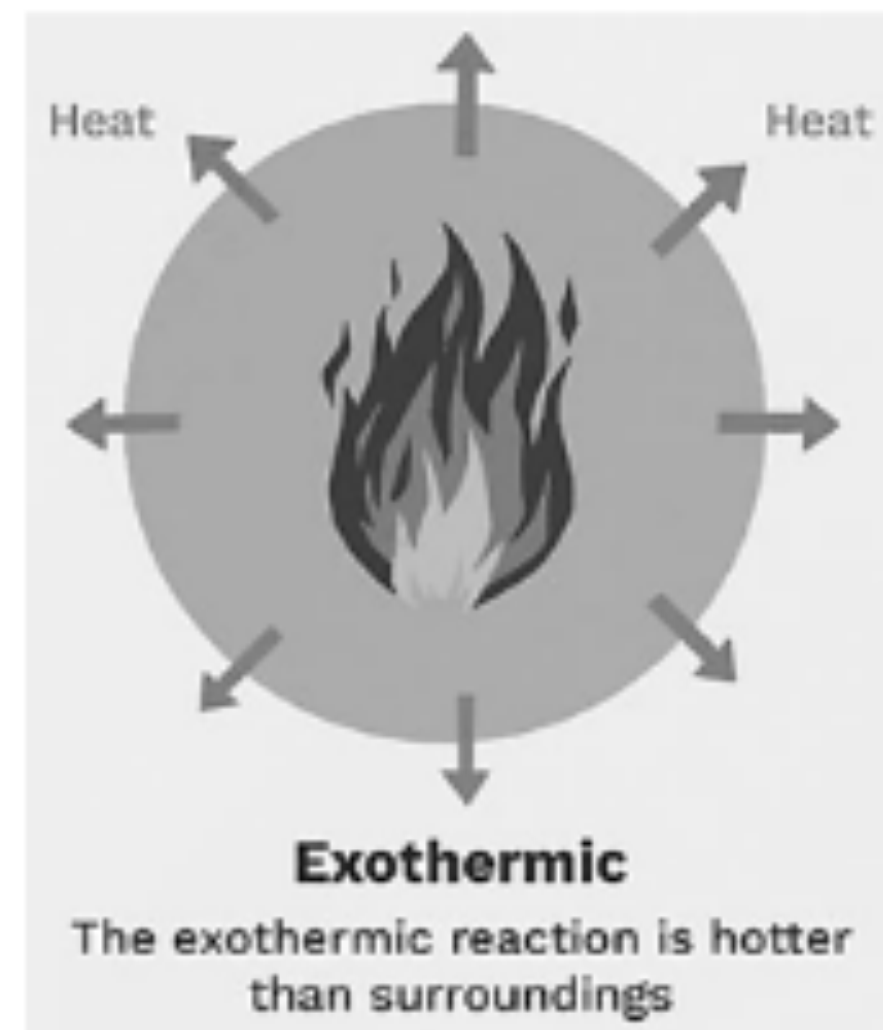
Chemical property

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

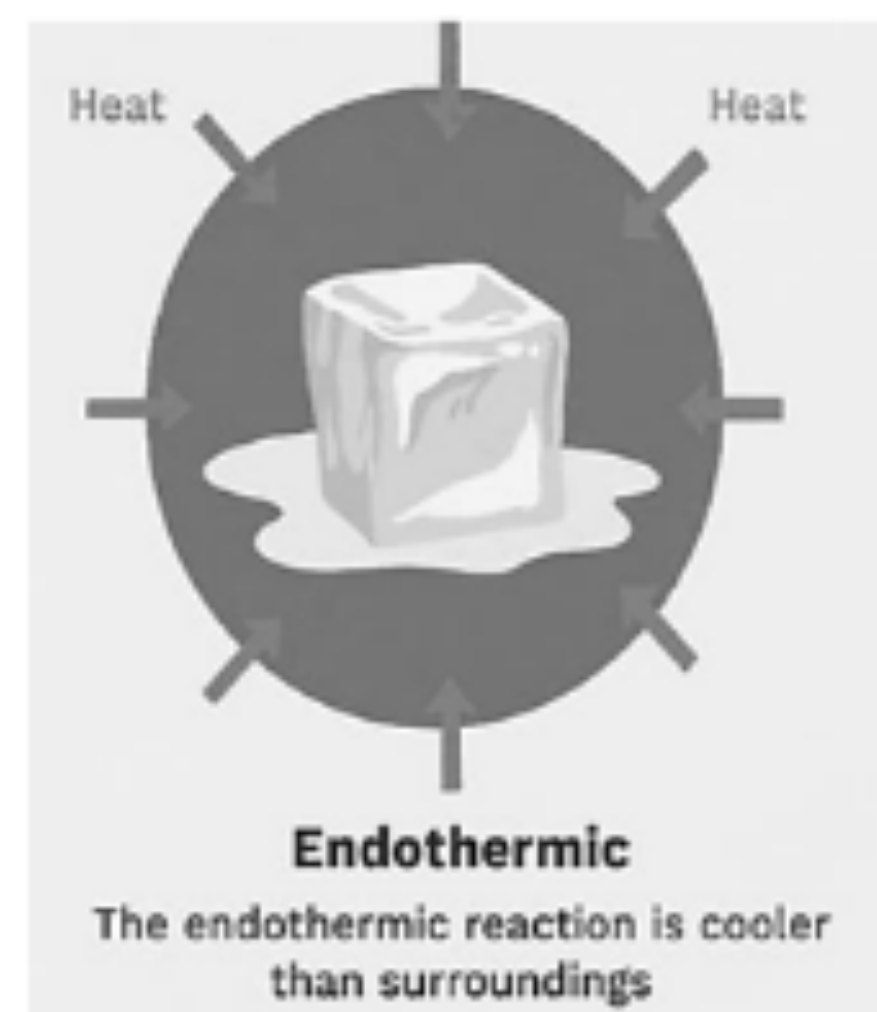
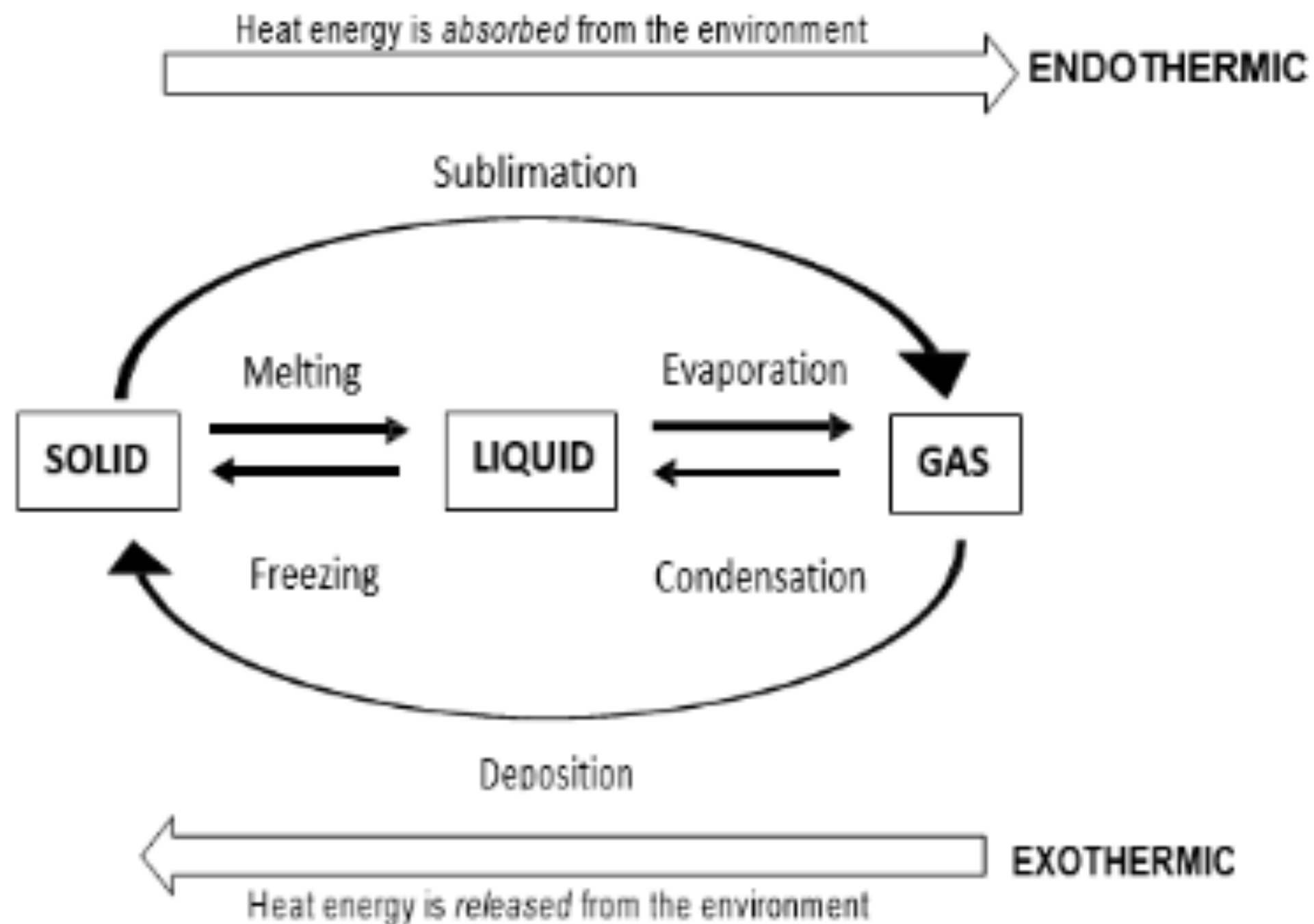
Ex: Flammability, reactivity, inertness, chemical stability

CHANGES THAT MATTER UNDERGOES

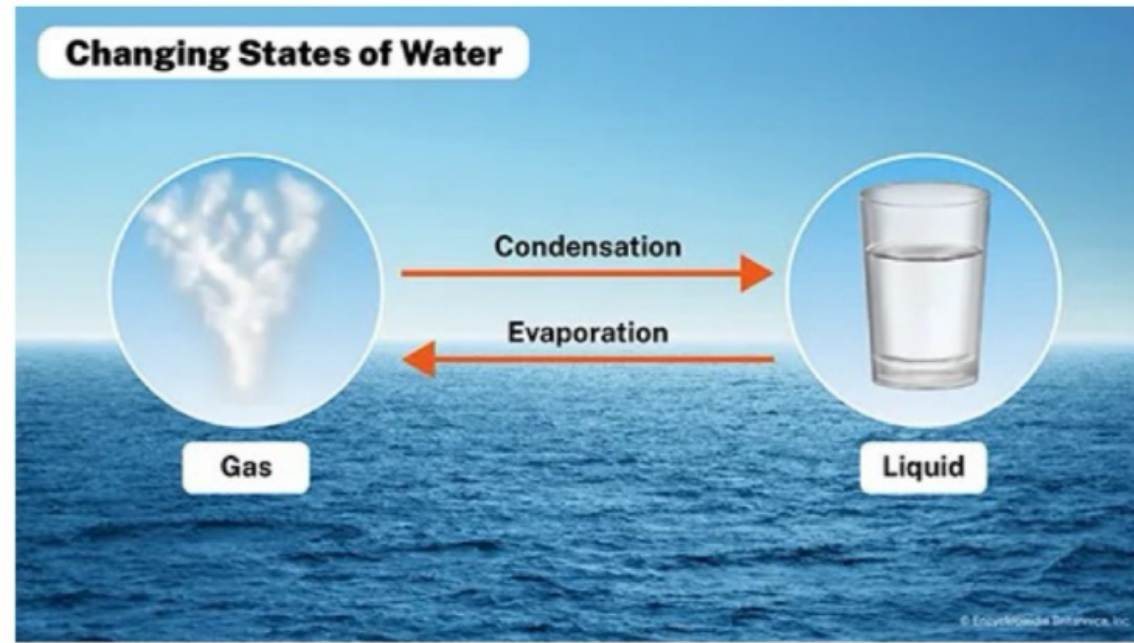
1. Physical Change – Changes that alter only state or appearance but not composition



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



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



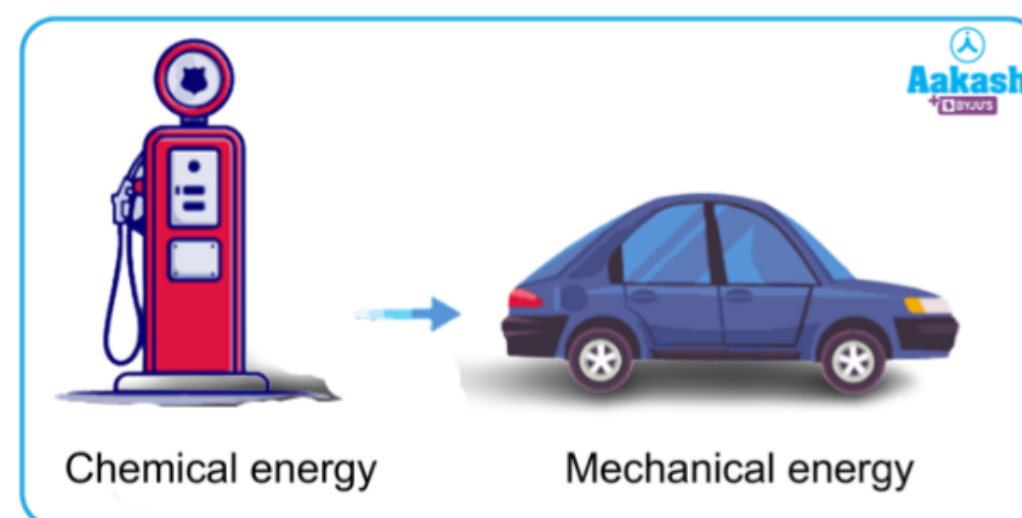
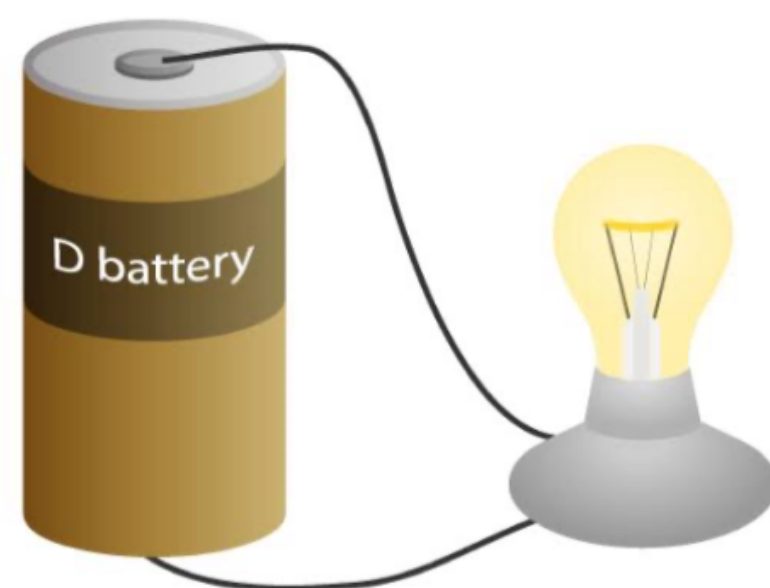
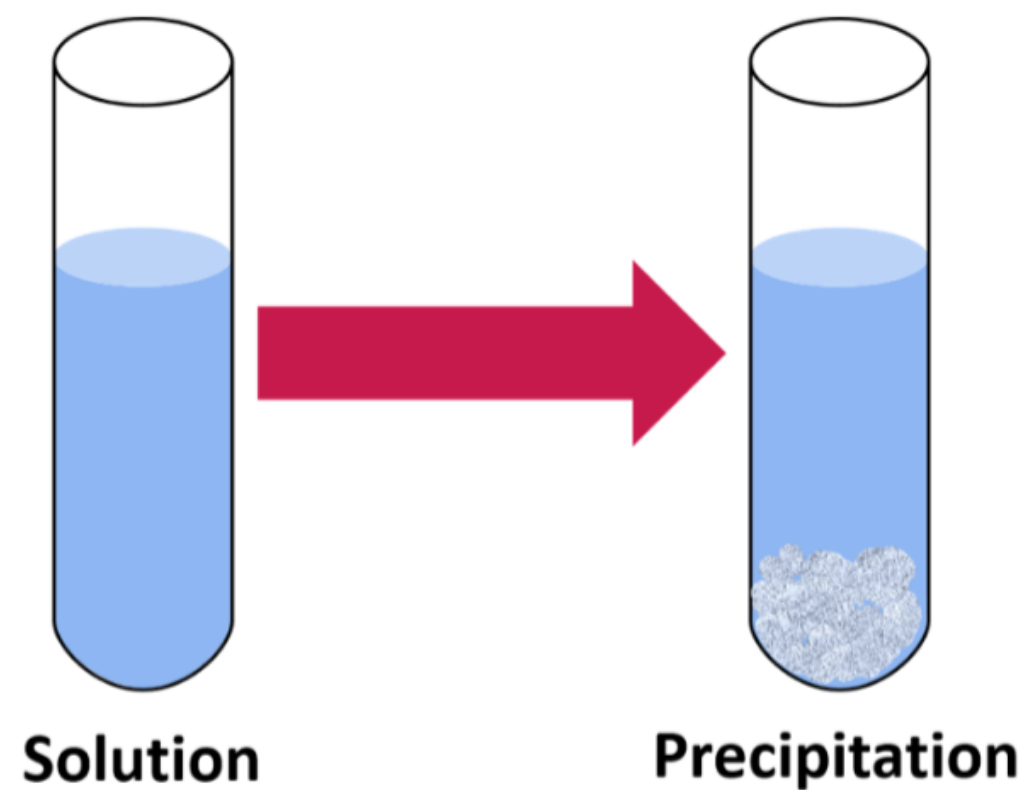
CHANGES THAT MATTER UNDERGOES

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

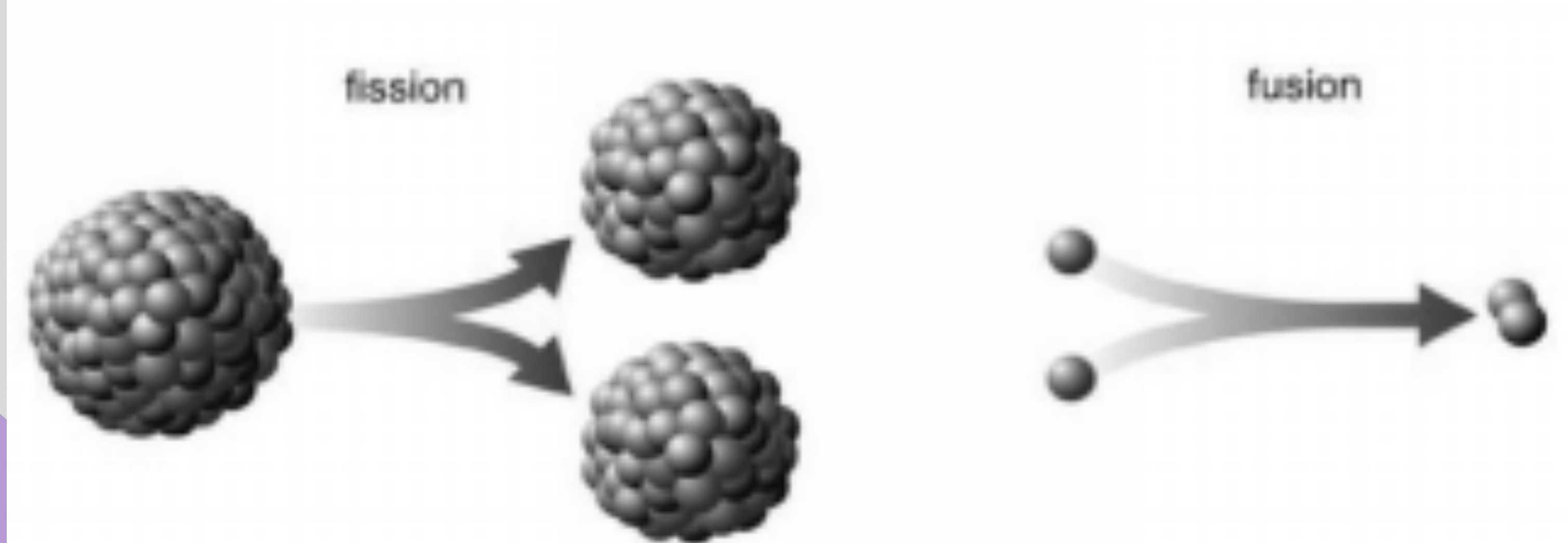


CHANGES THAT MATTER UNDERGOES

3. Nuclear Change - change 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 (μ m) = 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.

Any number
between 1 and
10 but not
including 10

Formula

$$N \times \underline{10^n}$$

Exponent

Base of 10

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

$4.5 \times 10^{\text{exponent}}$

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

$$4.5 \times 10^4$$

$$9,562,157 = 9.562157 \times 10^6$$

$$0.000015 = 1.5 \times 10^{-5}$$

$$0.000251 = 2.51 \times 10^{-4}$$

Handling of Numbers

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

$$4.5 \times 10^4$$

$$9,562,157 = 9.562157 \times 10^6$$

$$0.000015 = 1.5 \times 10^{-5}$$

$$0.000251 = 2.51 \times 10^{-4}$$