

#1. CLASSIFICATION OF MATTER

#1.1 INTRODUCTION: MATTER

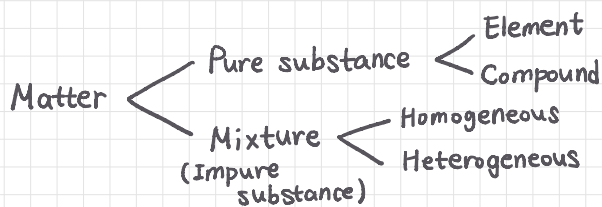
VS Waves (light, sound...)

* **Matter**: anything that has mass & occupies space
 ↳ being able to be identified by its location in terms of (x, y, z) coordinates

- Mass: the quantity of matter it contains
 ↳ atoms - basic building blocks of matter
 ↳ mass $\equiv$ total no. of atoms making up the matter
 $\neq$ weight

Mass VS Weight

- Weight: a force caused by the gravitational attraction that operates on the object
- Mass $\rightarrow$ X depends on the location of an object
 Weight $\rightarrow$ depends on the location "

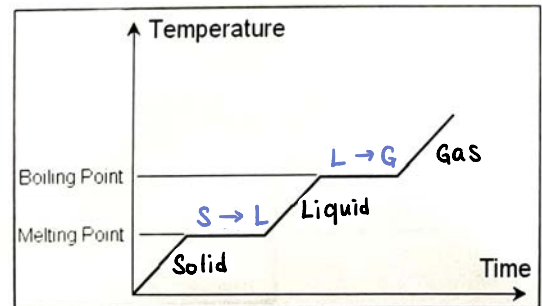


#1.2 PURE SUBSTANCES

[ELEMENTS & COMPOUNDS]

* **Pure Substance**: any matter that has a fixed chemical composition & characteristic properties
 ↳ a fixed ratio b/w the atoms making it up
 ↳ chemical, physical

- Having fixed chemical compositions $\rightarrow$ have properties that are constant throughout the whole sample
- constant appearance, colour, density, melting point & boiling point throughout the sample
- MUST display a sharp melting & boiling points
 ↳ a horizontal flat line where the temperature X change over time (on a graph $\downarrow$)



pure substances $\xleftrightarrow{\text{always}}$ homogeneous
 homogeneous $\xleftrightarrow{\text{X always}}$ pure substances

- **homogeneous** - has the same type & distribution of particles throughout, and a definite, fixed components
 (i.e. having uniform composition throughout the whole sample / substance)
 ↳ can only see 1 phase
 ↳ can only identify 1 component by visual observation
- X separated into 2 or more substances by physical means (e.g. distillation)
 ↳ i.e. by using physical separation technique
 ↳ but can be separated by chemical means
- [elements
 compounds

an element = plural of an atom

* **Elements**: pure substances that consist of only one type of atom

→ X decomposed (broken down) or separated into simpler substances (by neither chemical/physical means)

- In the Periodic Table,
- unique name & chemical symbol

First 20 Elements to Memorise							
H hydrogen							He helium
Li lithium	Be beryllium	B boron	C carbon	N nitrogen	O oxygen	F fluorine	Ne neon
Na sodium	Mg magnesium	Al aluminium	Si silicon	P phosphorus	S sulfur	Cl chlorine	Ar argon
K potassium	Ca calcium						

- 92 naturally occurring elements & 20+ man-made elements (synthetic/artificial elements)
- Of the 92 naturally occurring elements:
 - > 2: liquids
 - > 11: gases
 - > 79: Solids

Liquid Elements	Gaseous Elements	Solid elements (some examples below)
1. mercury (Hg) 2. bromine (Br)	1. hydrogen (H) 2. helium (He) 3. nitrogen (N) 4. oxygen (O) 5. fluorine (F) 6. neon (Ne) 7. chlorine (Cl) 8. argon (Ar) 9. krypton (Kr) 10. xenon (Xe) 11. radon (Rn)	• lithium (Li) • carbon (C) • sodium (Na) • magnesium (Mg) • aluminium (Al) • silicon (Si) • phosphorus (P) • sulfur (S) • potassium (K) • calcium (Ca) • zinc (Zn)

* **Compounds**: pure substances composed of two or more elements that are chemically combined in fixed proportions
 → forming chemical bonds b/w these elements
 → can be decomposed into simpler substances by chemical means
 → chemically breaking down
 → by breaking chemical bonds

	Element	Compound
Similarities	- fixed composition - fixed characteristic properties - X decomposed by physical means - homogeneous	
Differences	- consist of 1 type of atoms - X decomposed by chemical means	- consist of 2 or ↑ types of elements - can be decomposed by chemical means

• **Compounds** have quite different properties from their constituent elements

- **Example: Water**



- **Example: Iron (II) sulfide**

	Iron	Sulfur	Iron (II) sulfide
State at 25°C	Solid	Solid	Solid
Colour	Grey	Yellow	Black
Melting point (°C)	1535	113	1195
Boiling point (°C)	2750	445	Decomposes
Density (g/mL)	7.9	2.1	4.8
Magnetic	Yes	No	No

□ physical mixing
 e.g. Black + White → Grey mixture

□ chemically combining (chemical reaction)
 e.g. Black + White → Red compound

#1.3 MIXTURES

* **Mixtures (impure substances)**: Combinations of two or more pure substances in variable proportions in which each component retains their identity (properties)

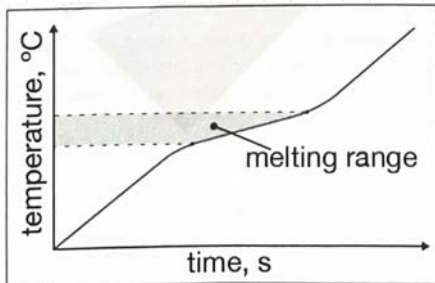
↳ displays the properties of the pure substances making it up

- can be separated into their components by physical means,
cuz each pure substance retains its own properties

e.g. Salt + Sand mixture
 ↓ ↓
 dissolved in water X dissolved

- has a composition that can be varied by changing the proportion of pure substances making it up
 hence → have variable properties

- MUST have a range of melting & boiling pts, unlike pure substances w/ a sharp mp/bp



X horizontal flat line, but a slope instead

* **Homogeneous Mixtures**: have uniform composition and properties throughout

(i.e. composed of one phase where all portions of a material are in the same state,

↳ have no visible boundaries & are uniform throughout
 evenly & uniformly distributed components

• **Examples**

- A solution of two or more substances
 ↳ most: liquids, can also be gas or solid
- Any mixture of gases

* **Heterogeneous Mixtures**: not uniform in composition and properties throughout

↳ can identify at least 2 or ↑ separate components by visual observation

#1.4 PURE SUBSTANCE VS MIXTURE IN SUMMARY

Pure Substance	Impure Substance (Mixture)
Particles are chemically bonded	Particles are physically bonded
cannot be separated into simpler substances by physical means	can be separated into two or more pure substances by physical means
has a fixed composition, no matter how it is made or where it comes from	has a variable composition; that is, the relative amounts of each component can be varied
has properties which are constant throughout the whole sample and also do not change regardless of how it is prepared or how many times it is subjected to purification procedures	displays the properties (characteristics) of the pure substances making it up and these properties can change as the relative amounts of the substances present are changed
homogeneous	homogeneous or heterogeneous

#1.5 A CLASSIFICATION SCHEME

