#1.3 MIXTURES

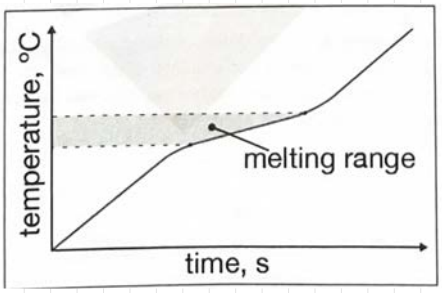
* **Mixtures** (impure substances): Combinations of two or more pure substances in variable proportions in which each component retains their identity (properties)
  ↳ displays the properties of the pure substances making it up

- 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

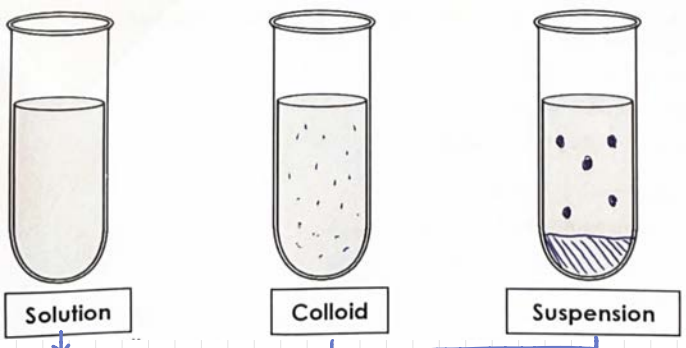
(i.e. composed of one phase where all portions of a material are in the same state, have no visible boundaries)
↳ always seem to consist of only 1 substance

solute – the substance which is dissolved
solvent – " in which the solute is dissolved

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

- **Aqueous Solution**: solute can vary but water must act as the solvent

* **Heterogeneous Mixtures**: not uniform in composition and properties throughout
  ↳ can identify at least 2 or ↑ separate components by visual observation

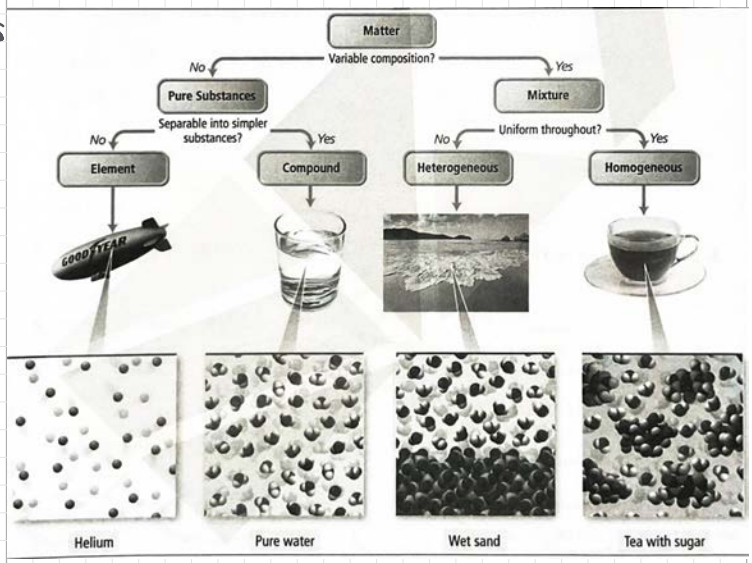


homogeneous — heterogeneous

#1.4 PURE SUBSTANCE VS MIXTURE IN SUMMARY

Pure Substance	Impure Substance (Mixture)
Particles are chemically bonded	Particles are physically (bonded) mixed
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



#2. STATES OF MATTER: THE KINETIC THEORY

#2.2 STATES OF MATTER

* **Kinetic Theory of Matter**: a tool to understand/explain the Similarities/differences b/w the 3 states, Solid · Liquid · Gas

#2.3 KINETIC THEORY (PARTICLE MODEL) OF MATTER

- A theory that explains the different properties of matter in different states (i.e. s/l/g) by providing a model for the behaviour of the small particles within it
- visualise what is happening at an atomic level (i.e. on a very small scale) inside the matter, in terms of

① how close (→ distance) the particles are to one another

② what motions they have

③ how strong are the forces of attraction b/w pairs of particles

"Kinetic Theory of Matter" states that...

- Matter is made up of very small particles
  - constantly moving & hence colliding w/ each other
- All particles have kinetic (i.e. moving) energy
  - solid phase: least amount of energy
  - gas particles: greatest "
- Temperature of a substance: measure of the average kinetic energy
  - ↑ temperature → faster the particles move → ↑ kinetic energy
- At absolute zero (i.e. −273.15°C) (→ 0 K (Kelvin)) – no movement (→ min. possible temperature)
- Spaces between particles: solid < liquid < gas
- Attractive forces b/w particles become stronger as the particles come closer to each other

#2.4 APPLYING KINETIC THEORY

* **Solids**

- particles are packed closely together → cannot be compressed
- each particle occupies a fixed position in relation to its neighbours → locked in position
- definite shapes & definite volumes
- vibrate about their fixed positions in the limitted space available to them
  - → particles vibrate more as temperature ↑ while maintaining their positions
- $F \propto \frac{1}{d}$ ⇒ Strongest attractive Force b/w particles

* **Liquids**

- just enough spaces for the particles to slip past each other
- particles move relative to one another
  - → X have definite shapes, take the shape of container they are placed in
- possesses more kinetic energy compared to particles in solids
- increase in energy overcomes the attractive forces → provides ↑ space
- vibration & random translation (→ motion in a straight line)
- virtually incompressible → definite volume
  - ↳ due to negligible space b/w particles

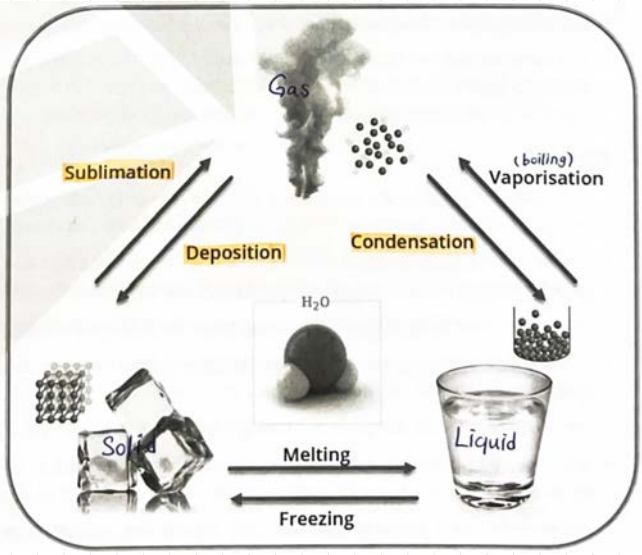
* **Gases**

- particles are much further apart than in solids or liquids
- very rapid random, straight-line motion
  - ↳ all collisions of gas molecules are perfectly elastic → no net energy loss during these collisions
- no significant forces b/w particles
  - → move virtually independently ⇒ virtually no attractive F
- Gas pressure: closer the particles, higher the pressure

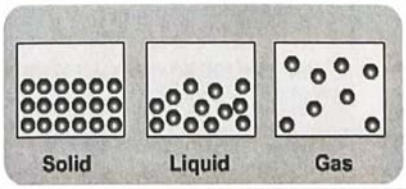
$$\text{Pressure of Gas} \propto \frac{1}{\text{V of container}}$$

↳ V of gas is variable as it depends on V of container

#2.5 CHANGES IN STATES (OR PHASES) OF MATTER



* Summary

Property	Solids	Liquids	Gases
Particle behaviour (space b/w particles & their motions)	Very closely packed, vibrating	Closely packed, vibrating & translational motion	Very far apart, translational motion
Density (S & L)	Very high	High	Low
Compressibility	Incompressible	Very slightly compressible (Virtually incompressible)	Highly compressible
Shape	Fixed (definite)	Variable	Variable
Volume	Fixed (definite)	Fixed (definite)	Variable
Diffusion (Mixing)	No diffusion	Yes at a slow rate	Yes at very fast rate
Pressure on (G) container	No	Some	Yes
Diagrams			
Energy (temp)	Low	Moderate	High

* Phase Change in terms of Particle Model

- When solid is heated → the particles move more vibrating, more vigorously
  ↳ weakening of forces
  → become so energetic that the forces of attraction can no longer hold the particles in position
  → melts to a liquid

When liquid is cooled → motion of the particles can no longer overcome the forces of attraction b/w them
→ freezes back to a solid

- When liquid is heated → some particles on the surface move so energetically
  ↳ breaking or completely overcoming the force
  → have enough energy to overcome the forces of attraction
  → form a gas

When a gas is cooled → motion of the particles can no longer overcome the forces of attraction b/w them
→ condenses back to a liquid

* Sublimation : directly solid ⟶ gas
e.g. CO_2
↕
Deposition : directly gas ⟶ solid
e.g. water vapour → ice during winter