

## Ch. 6

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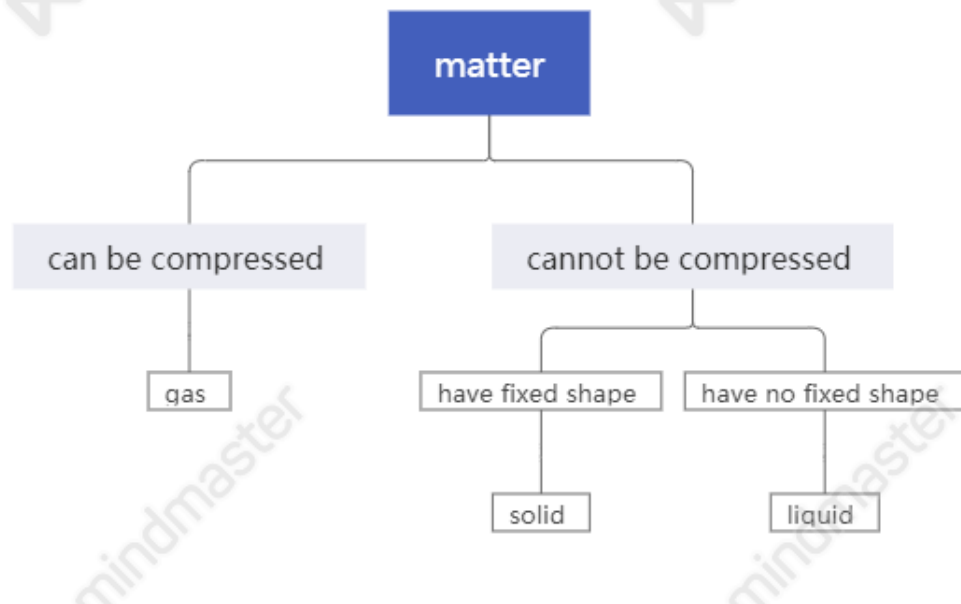
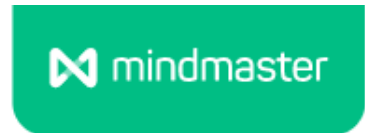
- Ch. 6.1 (particle theory)
  - matter
    - two properties (特性)
      - mass
      - take up space
    - no matter
      - light
  - basic idea
    - Democritus
      - matter was divided into smaller and smaller pieces
        - at some points, get very tiny pieces -- couldn't be further divided
          - called particles
            - particles -- building blocks of matter
    - Robert Brown
      - pollen grains move randomly on their own in still water
        - called Brownian motion
    - Albert Einstein
      - water -- made up of very small water particles
        - water particles -- much smaller than pollen grains
        - move in different directions
        - hit pollen grains in different directions from time to time
        - pollen grains -- move randomly in zigzag paths
  - particle theory
    - all matter -- made up of particle
    - particles -- very small
    - different matter -- made up of different particles
    - different particles
      - different sizes
      - different masses
    - particles -- move all the time
    - empty spaces between particles

- different types of particles
  - atoms(原子)
    - **basic types** of particles making up matter
    - some substances → made up of **only 1 kind** of atom
      - gold → gold atoms
      - iron → iron atoms
  - molecule (分子)
    - some substances → made up of molecules
    - consists of **two/ more atoms** joined together
    - some molecules consist of same kind of atom
      - 1 water molecule → 2 hydrogen atoms & 1 oxygen atom
      - 1 oxygen molecule → 2 oxygen atoms
      - carbon dioxide molecule → 2 oxygen atoms & 1 carbon atom
  - particles of different substances
    - different sizes
    - different masses
  - chemical formula of a molecule
    - each molecule → own chemical formula (化學式)
      - show → types & number of atoms
        - example
          - O<sub>2</sub>
            - O → 1 oxygen atom
            - 2 → 2 oxygen atoms in 1 oxygen molecule

## • 6.2 particle model

- properties of matter in 3 states
  - solid
    - ✓fixed shape
    - ✓fixed volume
  - liquid
    - ✗fixed shape

- ✓fixed volume
- gas
  - ✗fixed shape
  - ✗fixed volume
- 



- particle model
  - models in science
    - designing aeroplane → make model & test model in wind tunnel
      - help scientists study how aeroplane work
    - use models → study & explained how things work
      - illustrate structures of objects & real systems as well as concepts
    - use kinetic motion model → explain Brownian motion of fat droplets in water
  - arrangement & movement of particles in three states of matter
    - 
    - proposed particle model based on particle theory
      - help describe arrangement & movement of particles in solids, liquids & gases
    - solid
      - particles
        - close together & arrangement regularly

- **X move** from one position to another
    - only **vibrate** about **fixed positions**
  - particles in solids → like audience sitting in cinema
    - audience → close & in regular arrangement
- liquid
  - particles
    - **close** together
    - arrangement **irregularly**
    - move around each other
  - particles in liquid → like people in crowd
  - people → close
    - move through crowd
- gas
  - particles
    - **far apart**
    - move **freely** in all directions
  - particles in gases → like people running in all directions with lots of space between them
- scientists use particle model → describe arrangements & movement of particles in three states of matter.