

# Matter

- anything that takes up space and can be perceived!

What about the structure of matter? Matter as atoms!

small particles that are the building blocks of matter

## THE PHASES OF MATTER

### SOLIDS

- \* Rigid: Fixed shape AND fixed volume
- \* Dense: contain much mass in a given volume!

### LIQUIDS

- \* Variable shape ("fluid")
- \* Fixed volume
- \* Dense

↑ usually less dense than solid!

exception: water!

### GASES

- \* Variable shape ("fluid")
- \* Variable volume
- \* Not dense ("diffuse")

# An atomic picture of the phases of matter

## Solids:

- fixed shape, dense, fixed volume



- Atoms closely packed

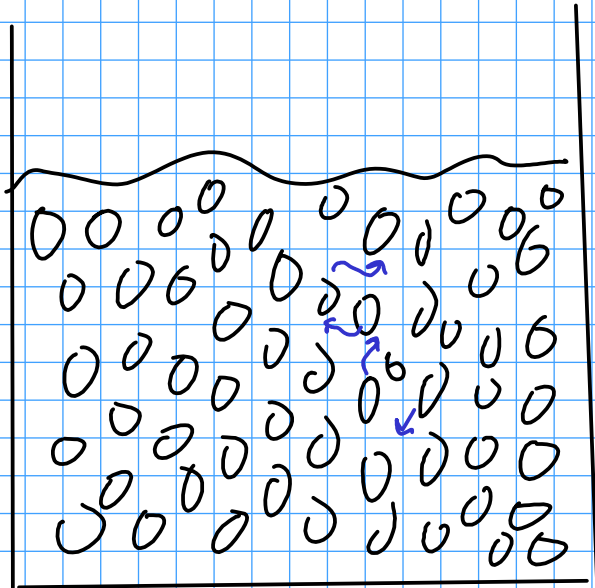
- Atoms are arranged in a regular structure (a CRYSTAL), giving the solid rigidity

- Atoms are strongly attracted to each other, keeping the solid together

- Atoms do not move about freely, but there is some vibration

## Liquids:

- variable shape, dense, fixed volume



- Atoms still very close to each other, but usually a little farther apart than in solid phase

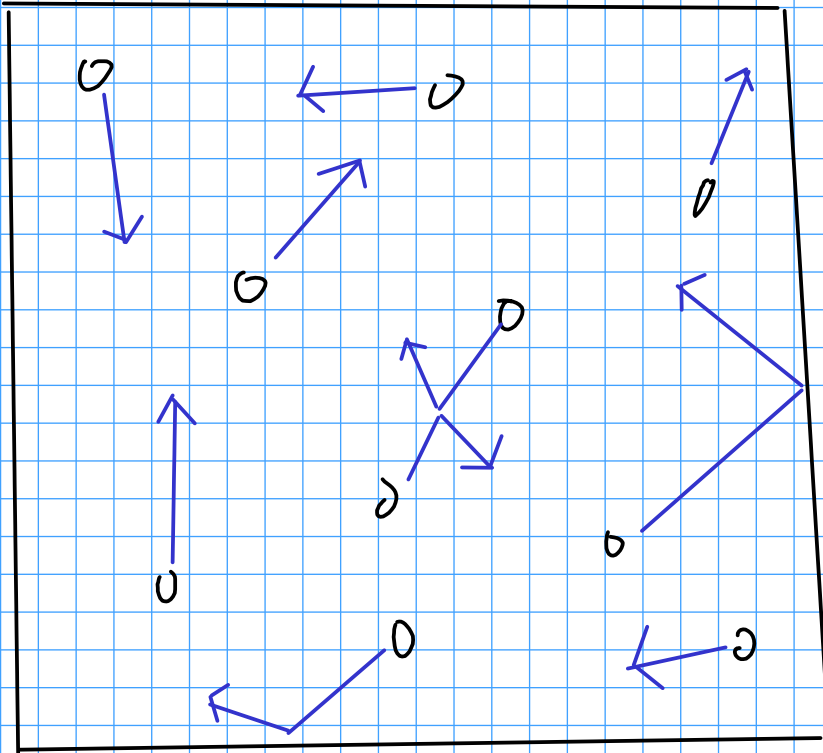
An exception: Water.

- Atoms are not arranged in an overall order and can slide past and around one another
- Atoms are still strongly attracted to each other, keeping the liquid together
- Atoms move around each other constantly

Evidence: DIFFUSION - a drop of food coloring in a glass of water will eventually spread throughout the glass, even if the glass is NOT stirred.

## Gases:

- variable shape, diffuse (not dense), variable volume



- Atoms are spread far apart

- No structure

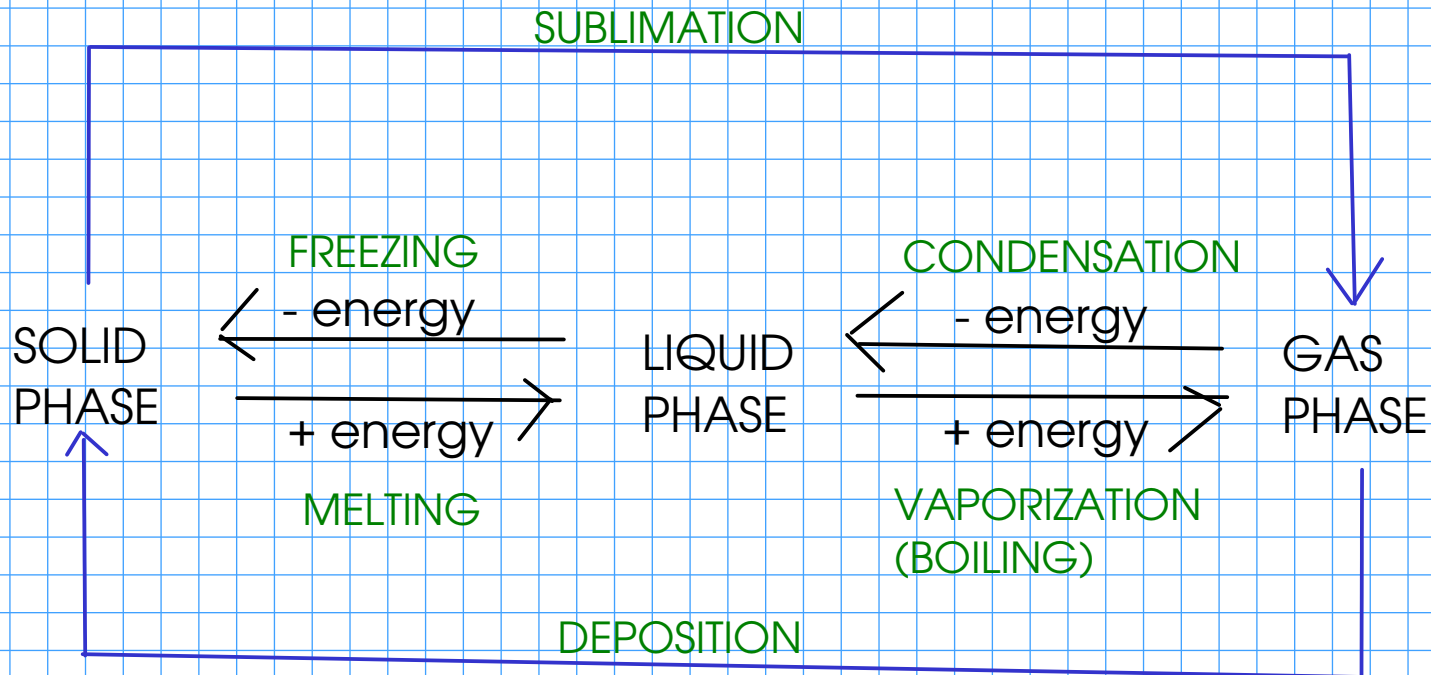
- Atoms are NOT strongly attracted to each other. They don't interact much at all, unless they happen to collide.

- Atoms in constant, rapid motion. The speed of the atoms increases as temperature increases.

Gases take the shape of their containers. Collision of atoms/molecule of gas with the walls of their containers create the effect we call PRESSURE.

## Kinetic theory

- describes matter in terms of atomic/molecular MOTION
- the energy of the molecules relates to atomic/molecular motion, and temperature



You can speed up the molecules (add energy) by heating!  
You can slow down the molecules (remove energy) by cooling!

## Physical and Chemical

- We classify changes in matter according to whether the identity of matter changes during the process.

### PHYSICAL CHANGE

- A change in the form or appearance of matter WITHOUT a change in identity

Examples:

- Melting, freezing (all phase changes) are physical; changes
- Breaking, cutting, etc. are also physical changes

### CHEMICAL CHANGE

- A change in the identity of matter
- also called "chemical reactions"

Examples:

- Burning, rusting, metabolism

We classify PROPERTIES of substances by whether or not you must change the identity of a substance to obtain information about the property

## PHYSICAL PROPERTIES

- can be determined without changing the identity of matter

Examples:

- size, shape, color, mass, hardness
- melting point, boiling point, density, etc.

## CHEMICAL PROPERTIES

- can only be determined by changing the identity of matter

Examples:

- flammability, reactivity with acids, temperature at which thermal decomposition occurs