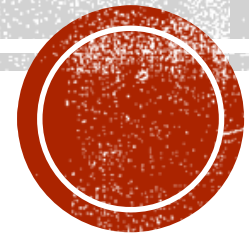
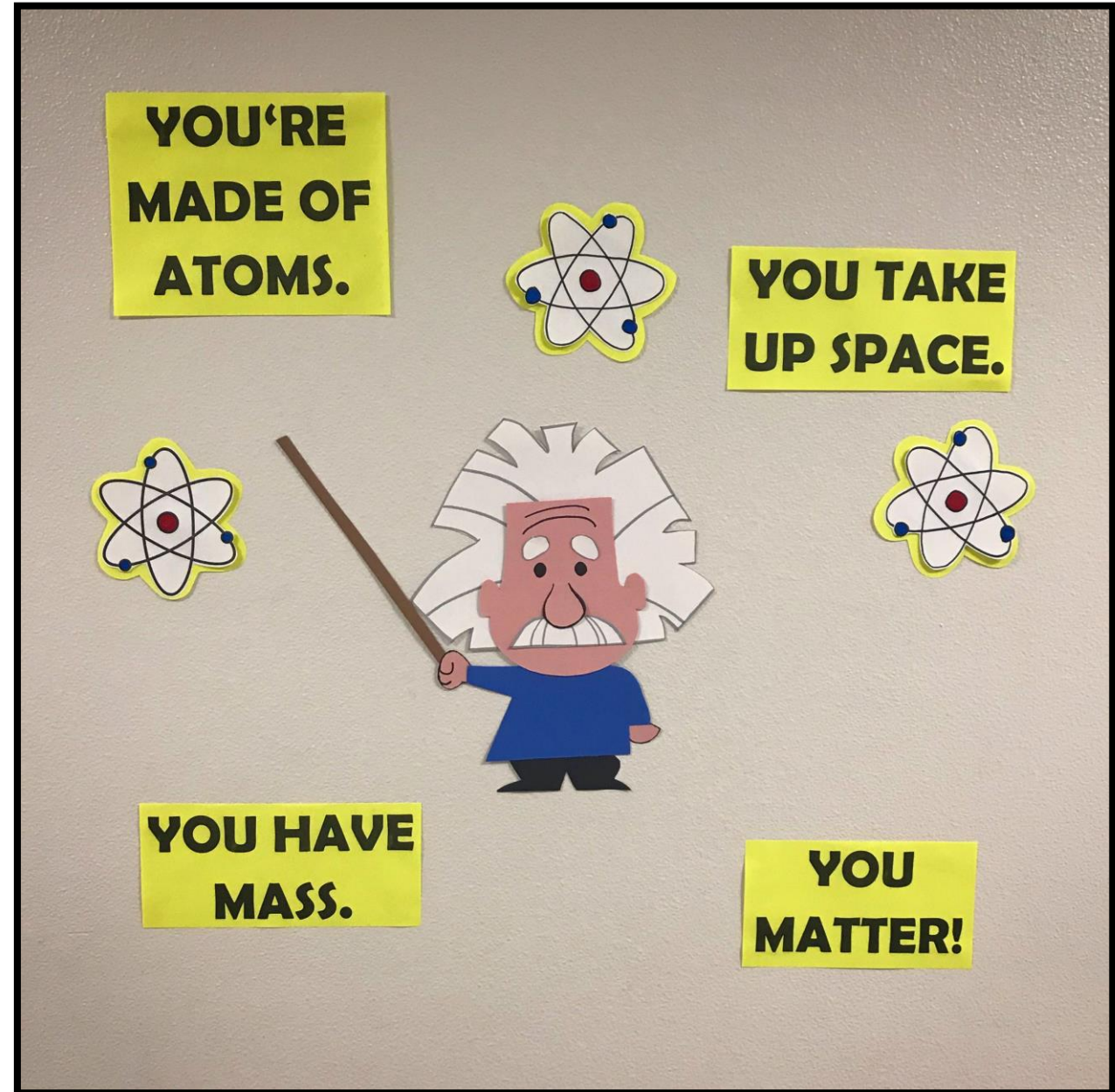


# 1.1 STATES OF MATTER



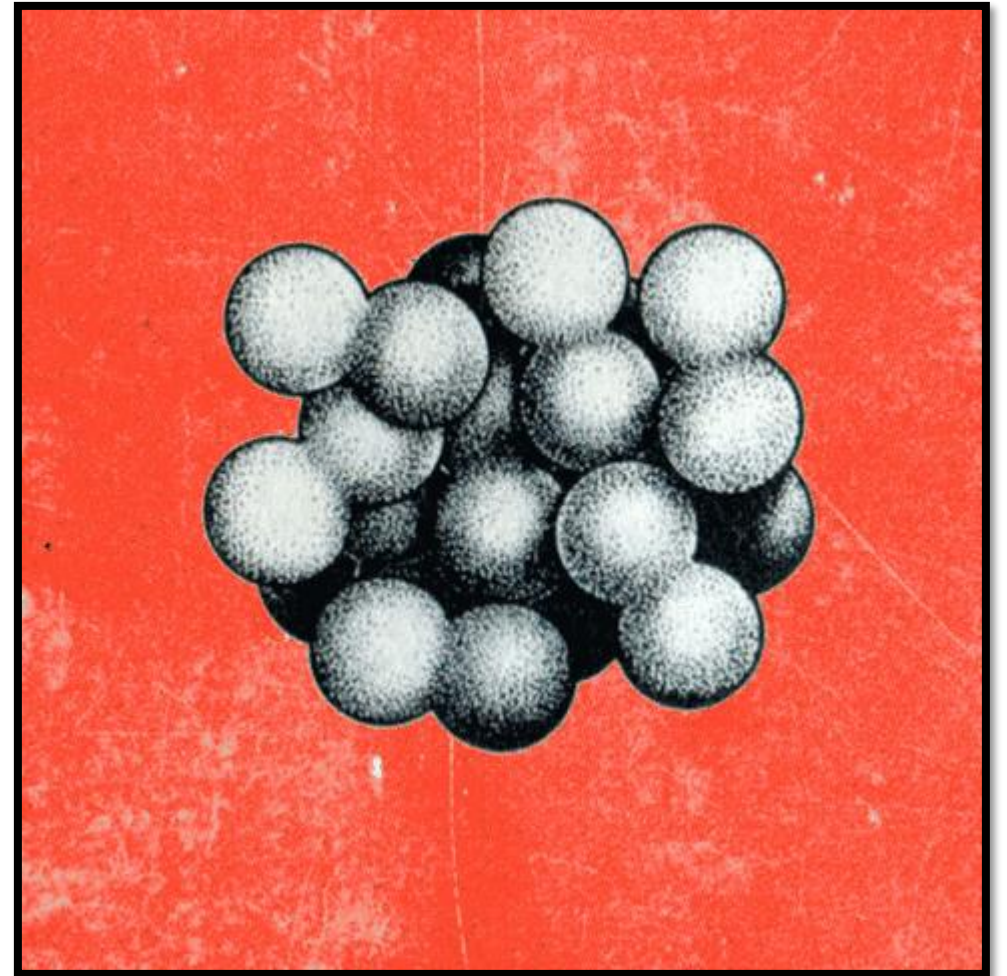
# MATTER

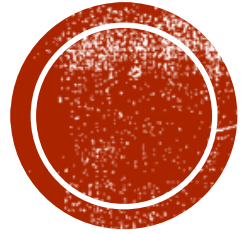
- Anything that has:
  - **Mass** (no matter how small)
  - **Volume** (takes up space)



# MATTER

- Matter is made up of tiny particles (atoms and molecules) that are so small they are invisible to us
  - Even most microscopes are not strong enough to see them
- Can only be seen with an electron microscope





# WHAT ARE THE STATES (PHASES) OF MATTER?

Solid, liquid and gas!

And plasma...

# STATES OF MATTER

- The states of matter are the different ways that particles are organized:

- **Solid**
- **Liquid**
- **Gas**
- *Plasma*



*(although we won't discuss this)*



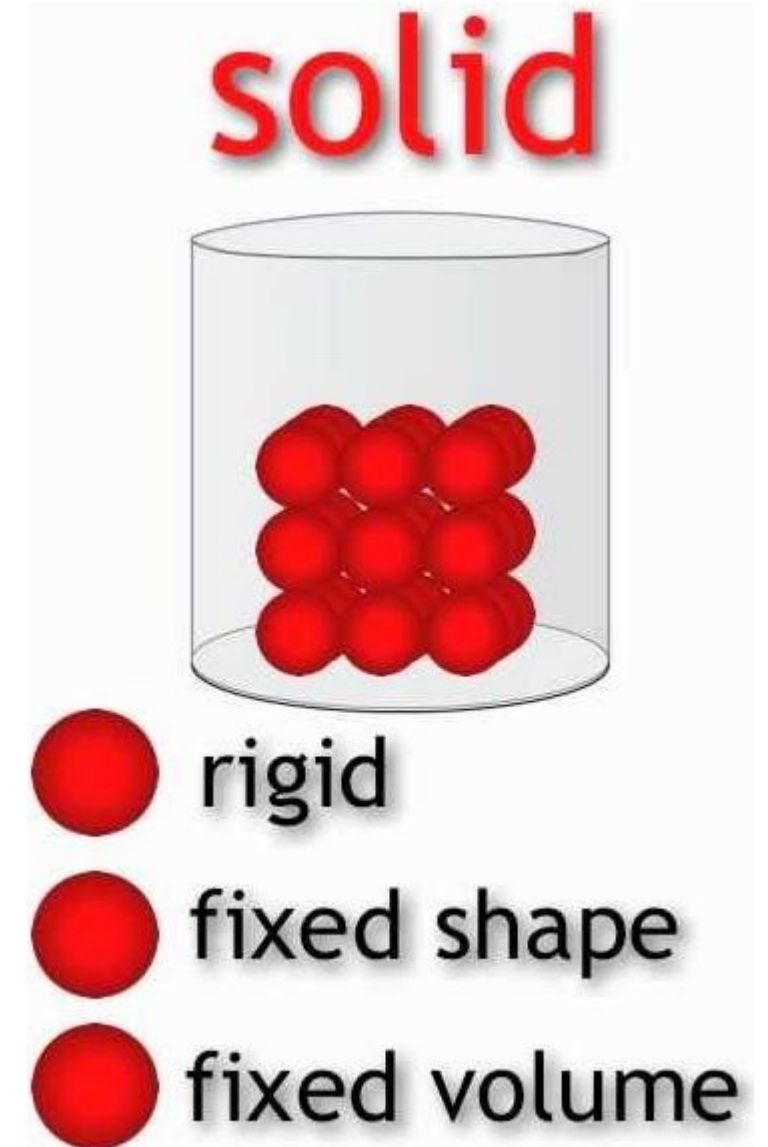
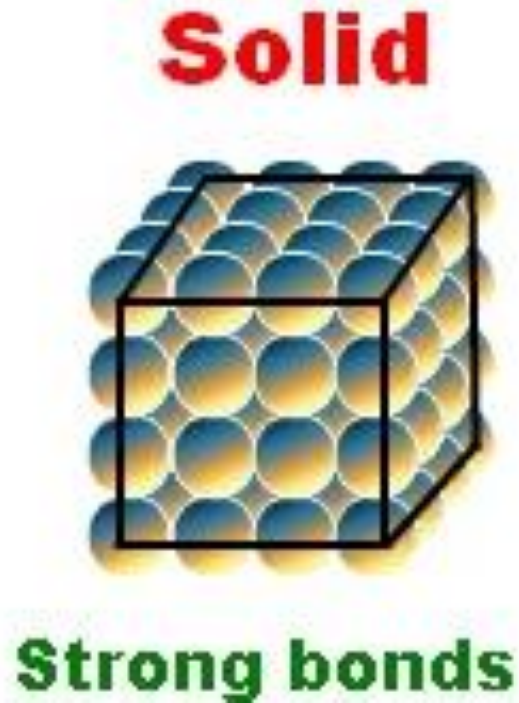


# STATES OF MATTER

## Solids

Have a **definite** (*specific*) **shape** and **volume**.

- Atoms are held together by **strong bonds**

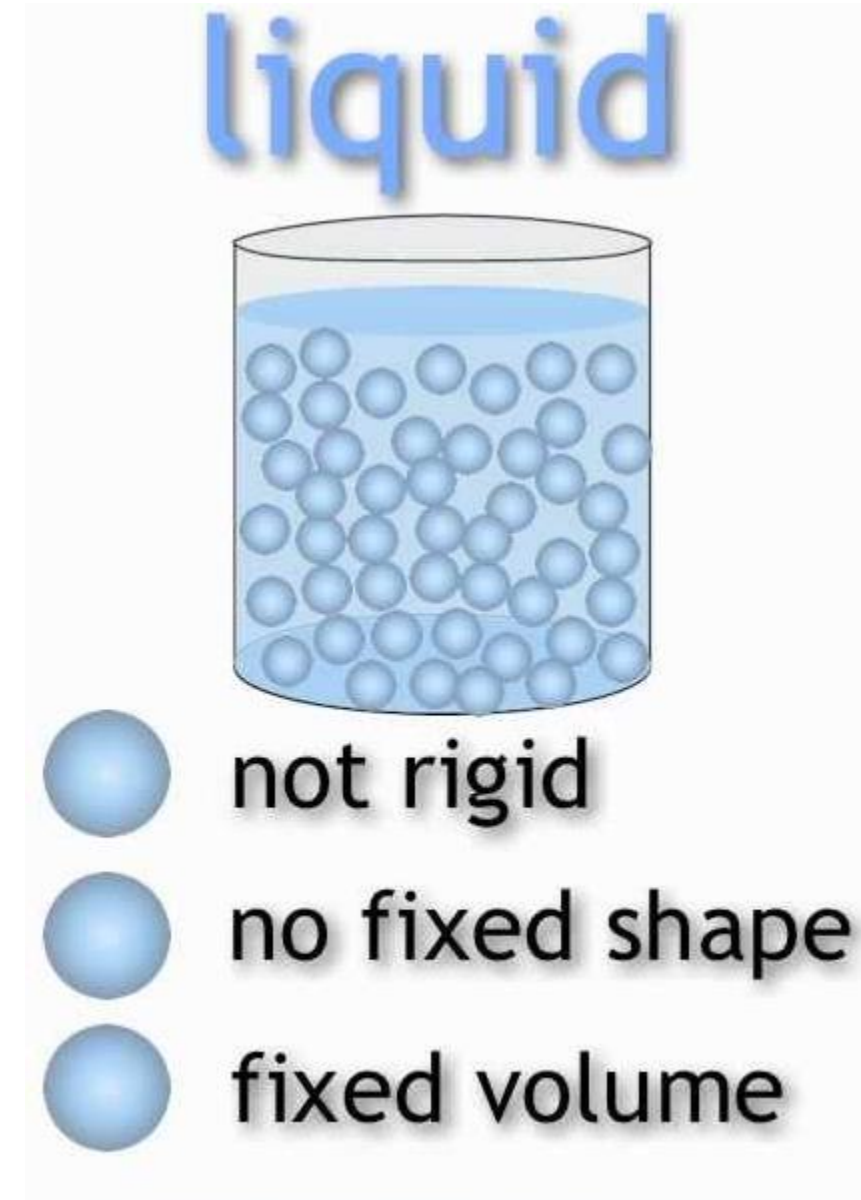
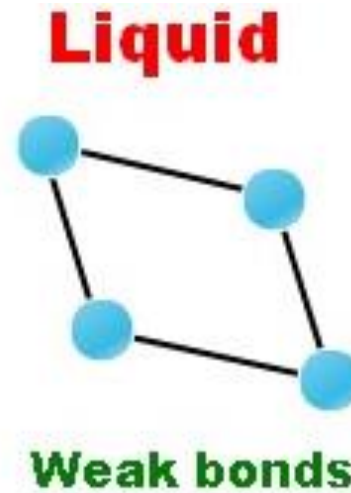


# STATES OF MATTER

## Liquids:

**no definite shape**, but has a **definite volume**

- Atoms spread out *to fit the shape of the container*
- Atoms are held by **weak bonds**





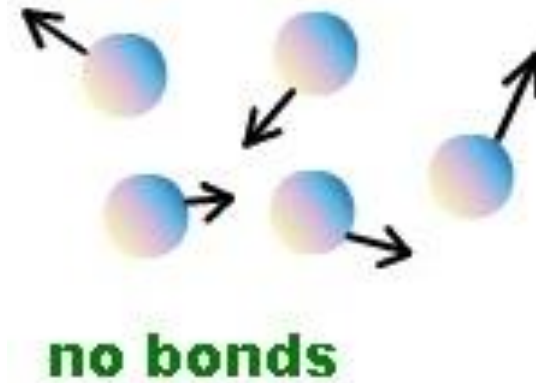
# STATES OF MATTER

## Gases

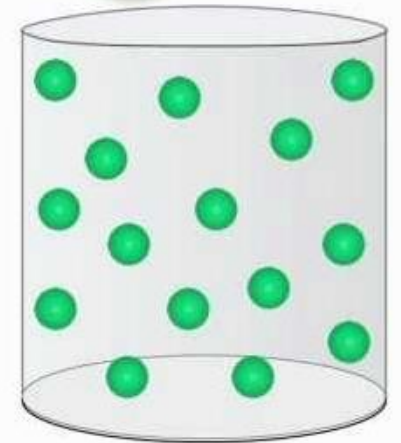
**no definite shape or volume**

- There are **no bonds** holding the atoms together
- Atoms of gases **spread out completely**

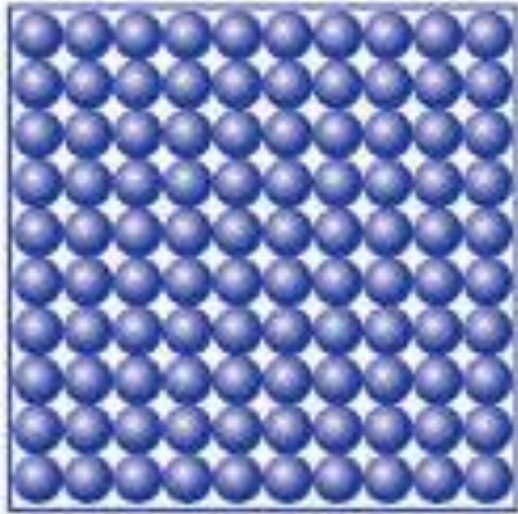
**Gas**



gas

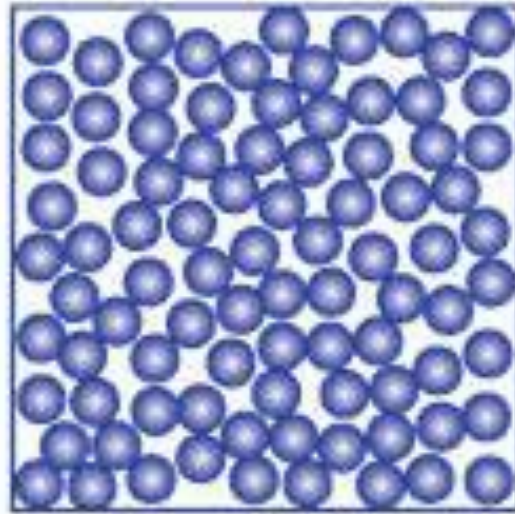


- not rigid
- no fixed shape
- no fixed volume



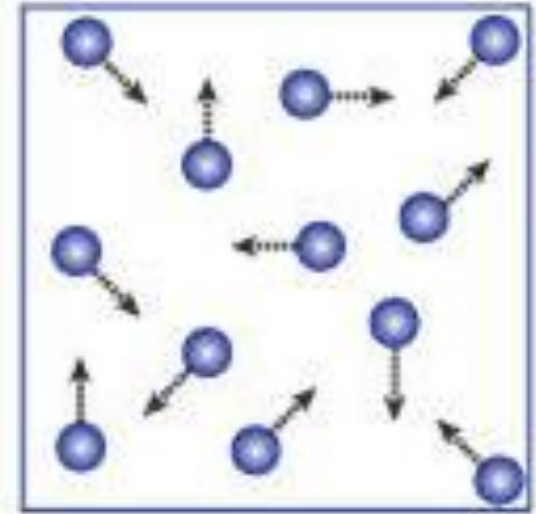
Solid

- Neatly arranged
- Strong forces of attraction between particles (physical bonds)
- No real movement of particles



Liquid

- Close together but not as structured as a solid
- Weak forces of attraction between particles
- Particles can slide over each other



Gas

- Far apart
- No forces of attraction between particles
- Move a lot!



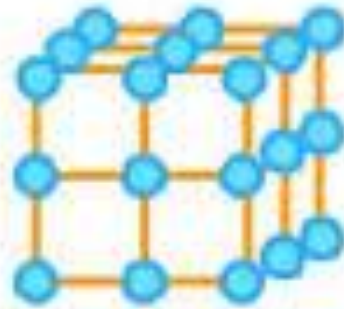
# PHASE CHANGES

- Substances in the different states of matter **can change state** by either **adding energy** (*heat*) or **removing energy** (*heat*)

**\*\*The more energy** atoms have, the **faster** they move!\*\*



# States of Matter



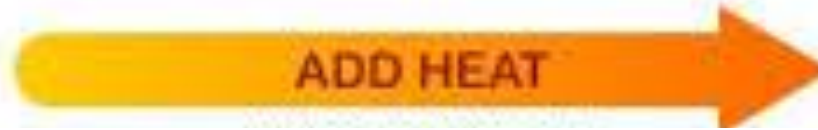
SOLID



LIQUID



GAS



SOLID



LIQUID



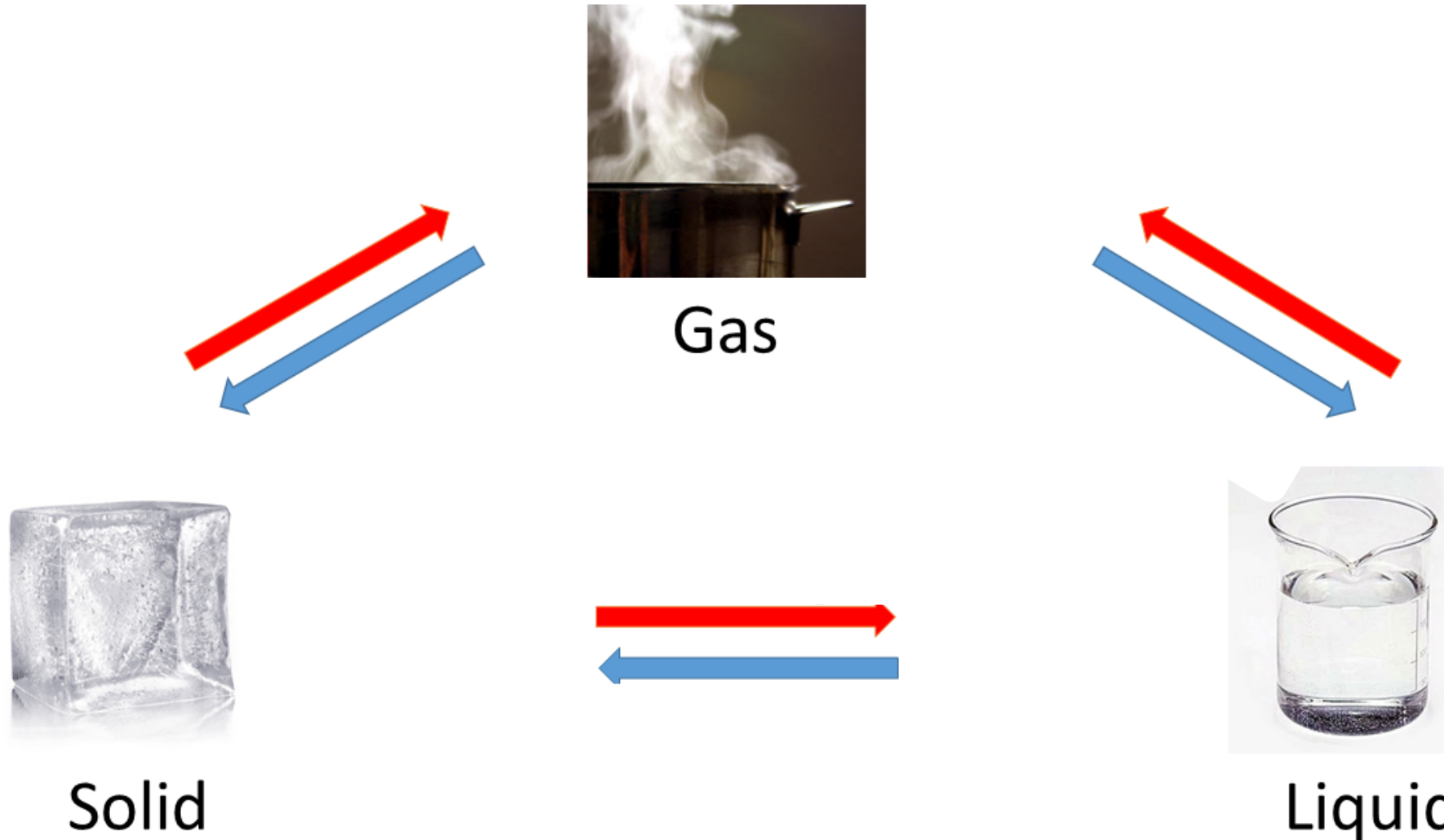
GAS



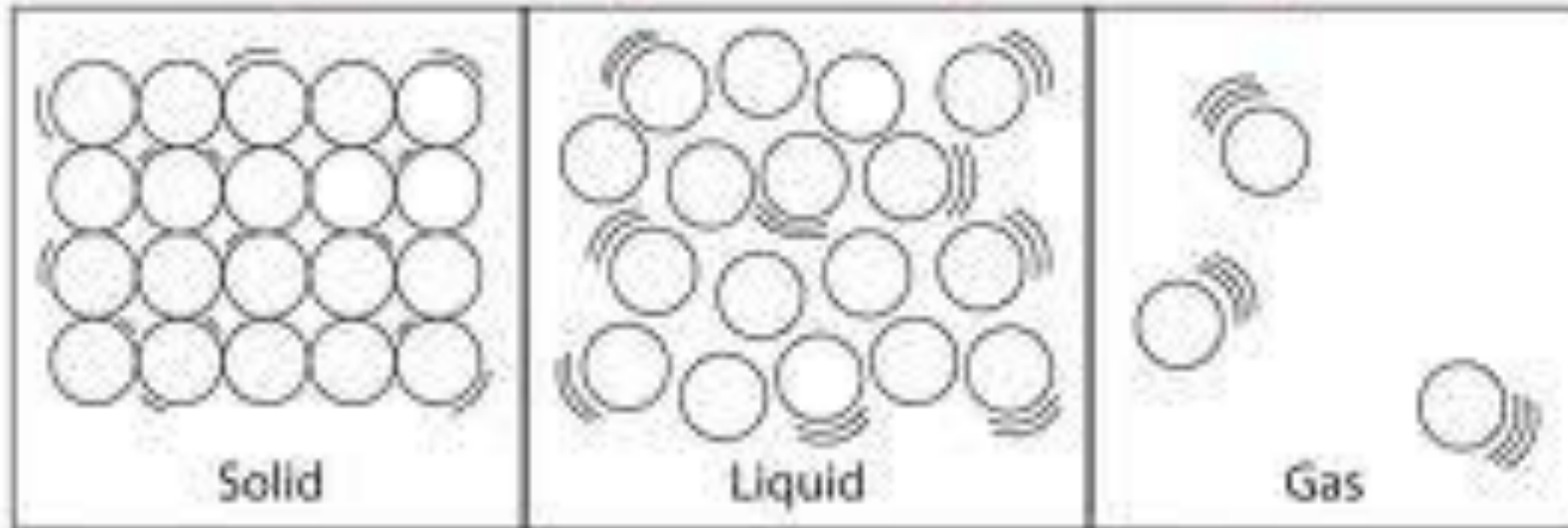
# TOPIC 3: PHASE CHANGES

**Red arrows:** adding energy/heat

**Blue arrows:** removing energy/heat



Adding  
Energy



Removing  
Energy



—

# CHANGES OF STATE

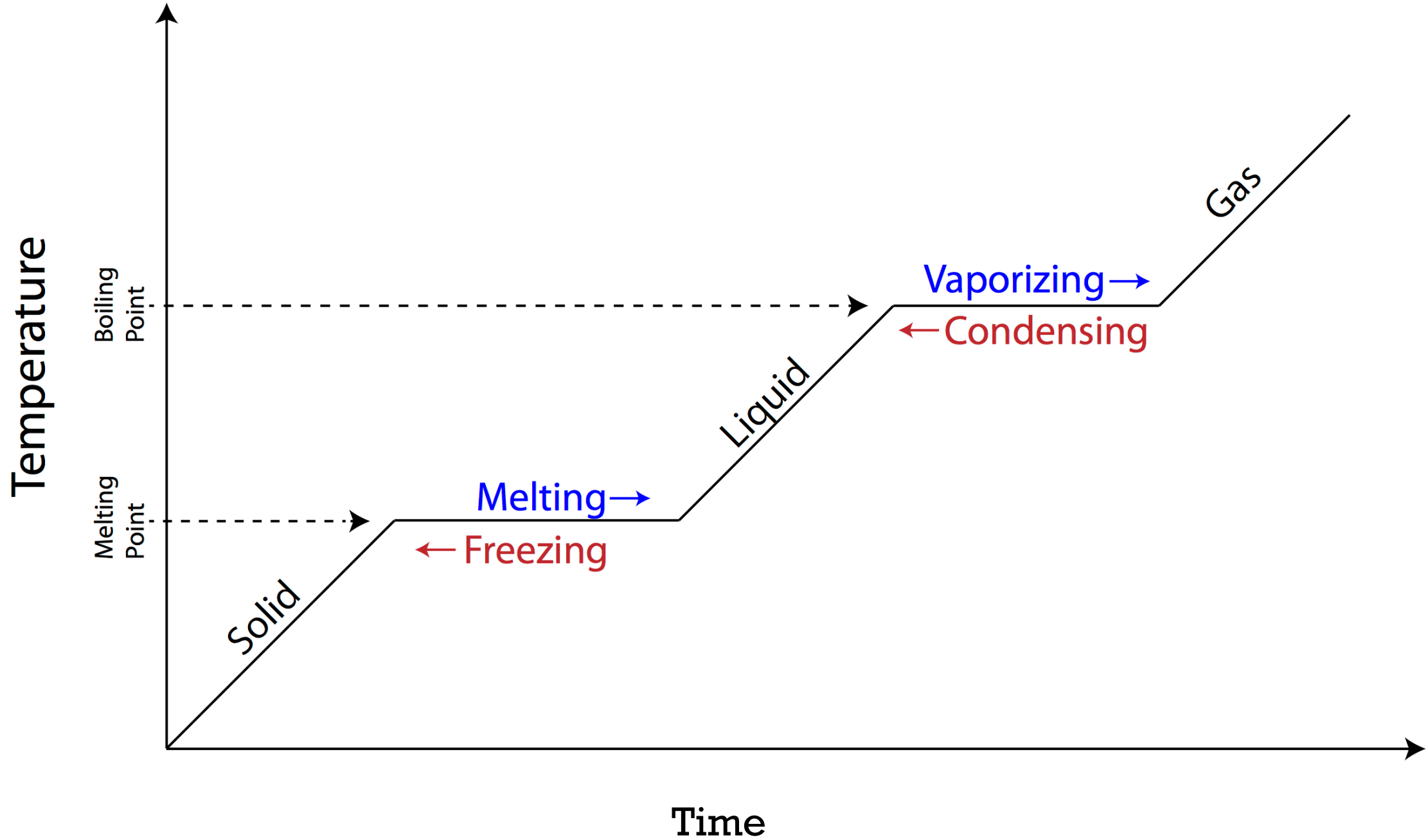
- When you heat up a substance (or cool it down), you will see that when the substance is at the point that it is **changing from one state to the other**, the **temperature will stay steady** for a while
  - We call this a **plateau**
- At this point the energy is being used to break apart the physical bonds instead of increasing the temperature (agitation of the particles)





<https://interactives.ck12.org/simulations/chemistry/ phases-of-matter/app/index.html?screen=sandbox>



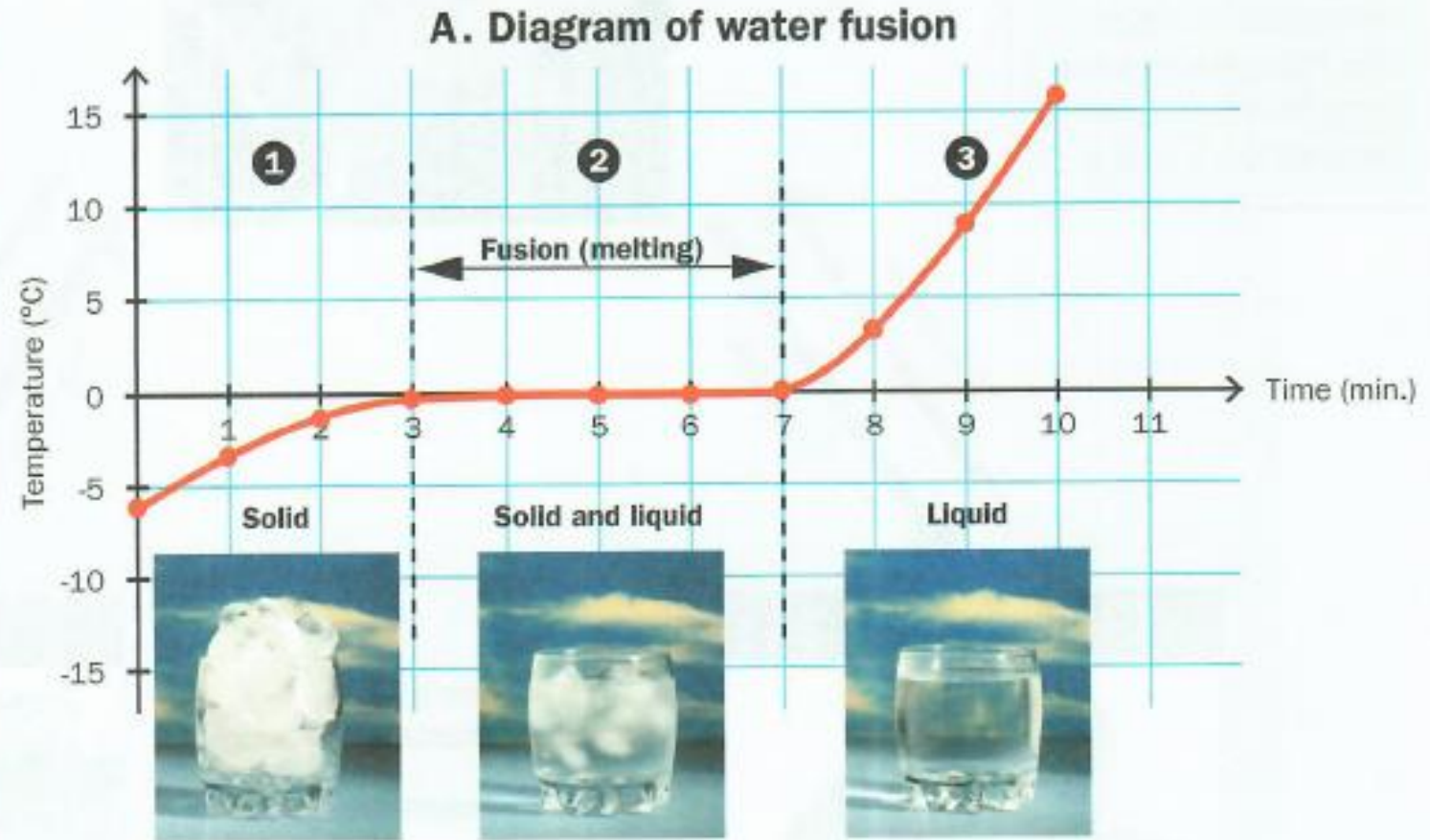


# STATES OF MATTER

1 Ice stays in a solid state until its temperature reaches  $0^{\circ}\text{C}$ .

2 At  $0^{\circ}\text{C}$ , the temperature of water stays stable for a certain amount of time. The curve shows a plateau at the melting point. The substance is both solid and liquid.

3 When all the water has turned liquid, its temperature starts to climb again.



# STATES OF MATTER

A substance's melting point is the temperature at which it goes from a solid state to a liquid state or vice versa.  
A substance's boiling point is the temperature at which it goes from a liquid state to a gaseous state or vice versa.

B. Diagram of water freezing

