


Matter

What is Matter?

- Anything that takes up space and has mass
- Made up of atoms or molecules
- Exists as three states(solid, liquid, gas)
**plasma as fourth state

Why are there different states of matter?

- Depends on how their atoms are arranged and how they move

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- Solids: particles are tightly packed and move slowly
 - Liquids: particles are held together, but not in a fixed position; particles move at a moderate speed
 - Gases: particles are spread apart and move quickly

Kinetic Theory of Matter

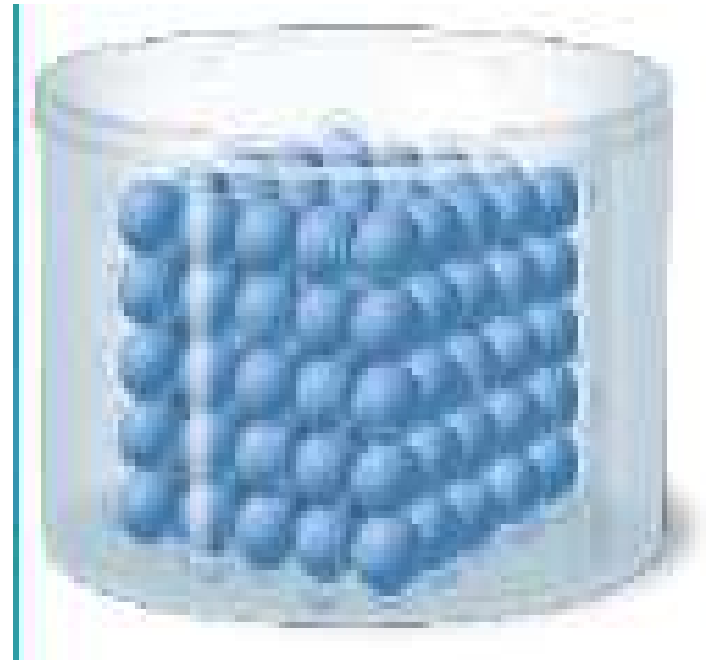
- All particles of matter are in constant random motion (Brownian motion)
- Particles move due to kinetic energy
- Amount of kinetic energy is measured by temperature
- The greater the temperature, the faster the particles
- Particles stop moving at absolute zero (-273.15°C)

Difference between heat and temperature

- Heat is the transfer of energy from higher temperatures to lower temperatures
- Ex: An ice cube melts in your hand because the energy from your hand is transferred to the ice cube

Solids

- Definite or fixed shape
- Definite volume
- Particles are arranged closely together
- Low kinetic energy; particles move slowly
- Can be crystalline or non-crystalline (amorphous)



Liquids

- Definite volume
- Takes shape of it's container
- Particles are held together but not in a fixed shape
- Fluid-flows freely
- Moderate kinetic energy; particles move at a moderate speed



Gases

- Fluid
- Changes volume
- No definite shape
- Particles are far apart
- Particles spread out until they hit a barrier
- High kinetic energy; molecules are moving quickly



Crystalline

- Particles are arranged in repeating geometric patterns
- Geometry of the crystals depends on size and number of particles
- Crystals are usually not very large
- Examples include: diamonds, salt, sugar, snow
- Crystal structures break down when melted
- Definite melting point

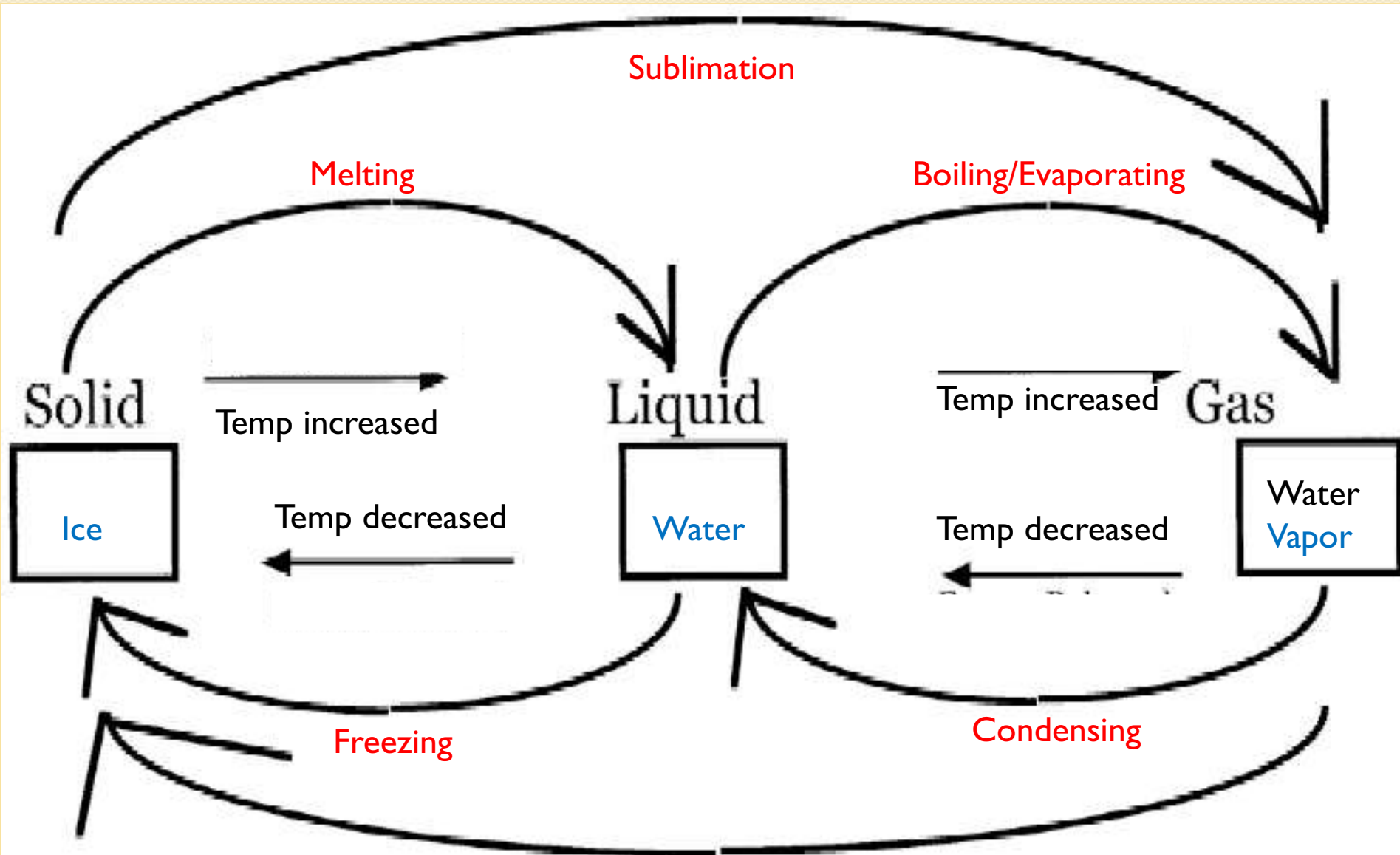
Non-crystalline

- Also called amorphous
- Have no definite pattern or form
- Large molecules are stuck in a random arrangement
- Examples include: glass, plastic
- No definite melting point; just get softer and softer

Solids



Phase Changes



Changes of State

- A substance changes states when energy levels increase or decrease significantly by the addition or removal of heat.
- As temperature increases, energy levels increase.
- As temperature decreases, energy levels decrease.

Changes between a Solid and Liquid

Melting

- change in state from a solid to a liquid
- added thermal energy (heat) makes water molecules vibrate faster causing them to break free from their fixed position.
- melting point of water = 0°C

Freezing

- change in state from a liquid to a solid
- removal of heat causes water molecules to slow down and form into a fixed position.
- freezing point of water = 0°C

Changes Between Liquids and Gases

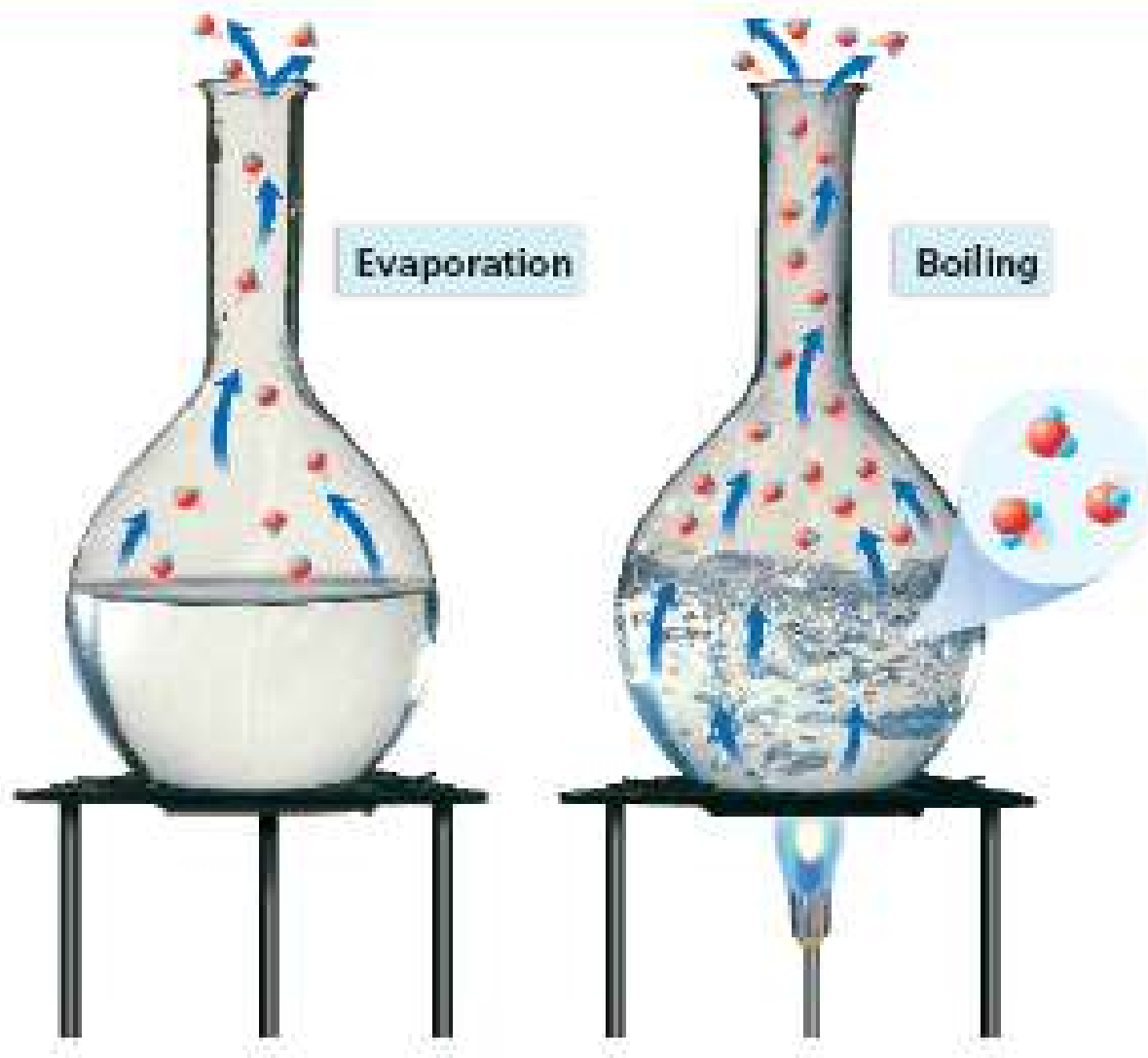
Condensation

- occurs when particles of a gas lose enough thermal energy to change back into a liquid

Vaporization (boiling/evaporation)

- occurs when the particles in a liquid gain enough thermal energy to form a gas.

K11 Evaporation and Boiling



Two Types of Vaporization

Evaporation

- takes place only on the surface of a liquid
- Water gains energy from ground, air, or sun

Boiling

- liquid turns to a gas below the surface and at the surface; forms bubbles throughout
- boiling point of water = 100°C (at sea level)

Changes between a solid and gas

Sublimation

- Particles of a solid gain enough energy to form directly into a gas without forming a liquid first
- Example: dry ice



Phase Change Diagram

