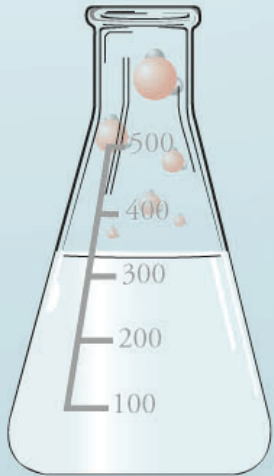
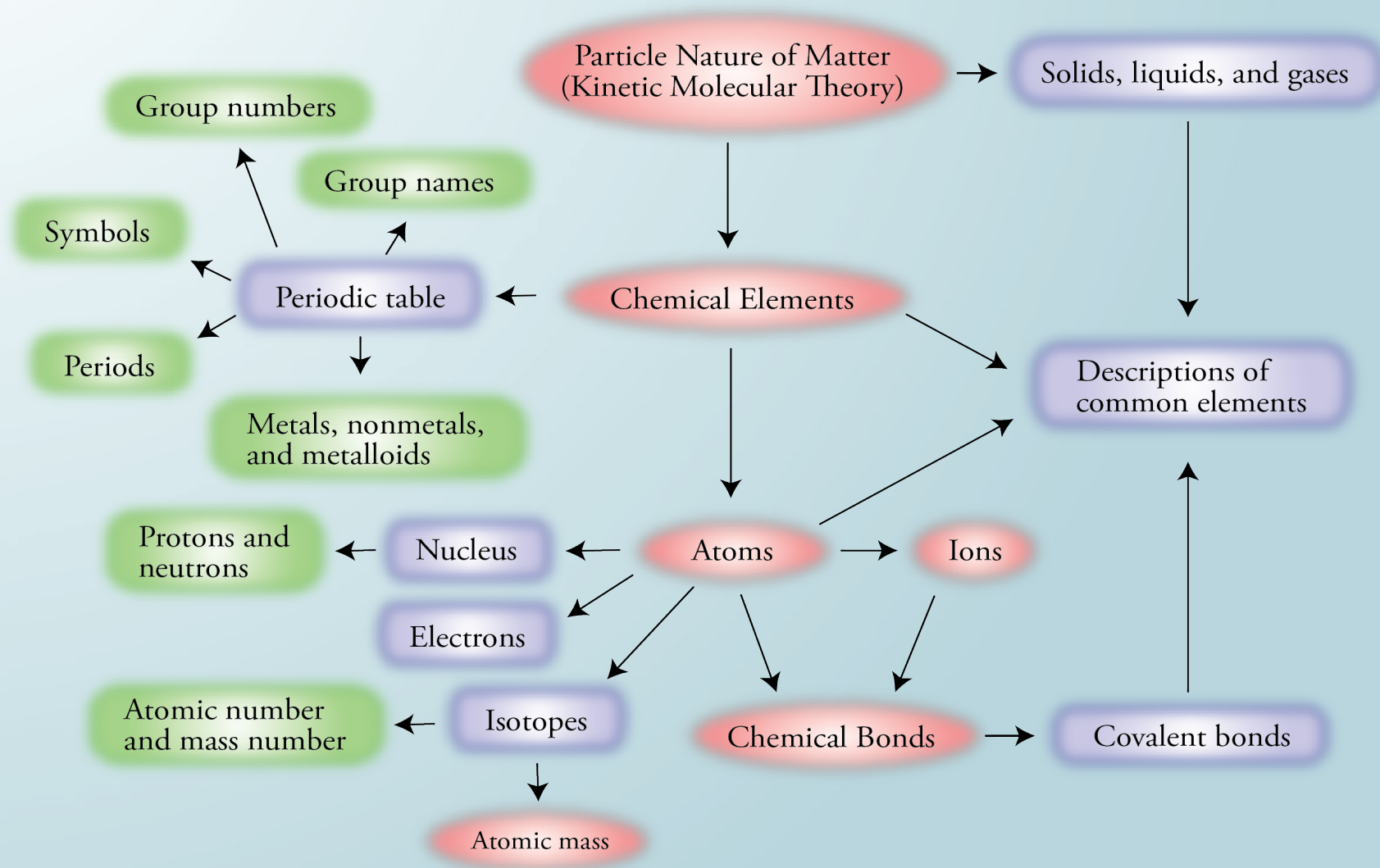


# Solids, Liquids, and Gases



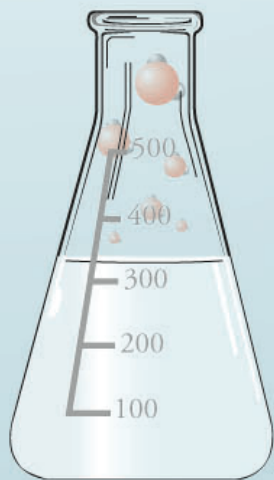
# Chapter Map



A series of water molecules, each consisting of one red oxygen atom and two black hydrogen atoms, arranged in a descending arc from the top left towards the center of the slide.

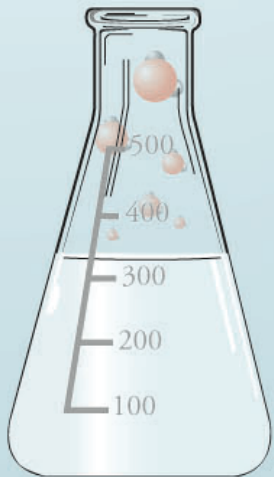
# Chemistry

The science that deals with the structure and behavior of matter



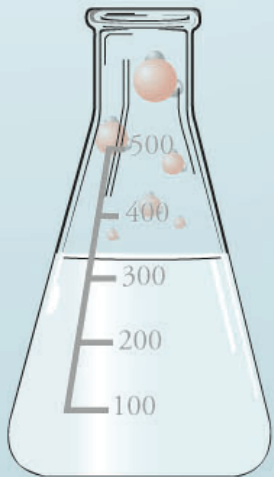
# Scientific Models

- A *model* is a simplified approximation of reality.
- Scientific models are simplified but *useful* representations of something real.



# Kinetic Molecular Theory

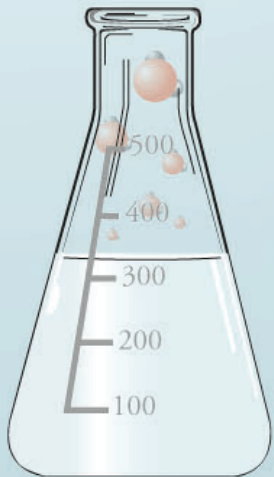
- All matter is composed of tiny particles.
- The particles are in constant motion.
- Increased temperature reflects increased motion of particles.
- Solids, liquids and gases differ in the freedom of motion of their particles and in how strongly the particles attract each other.



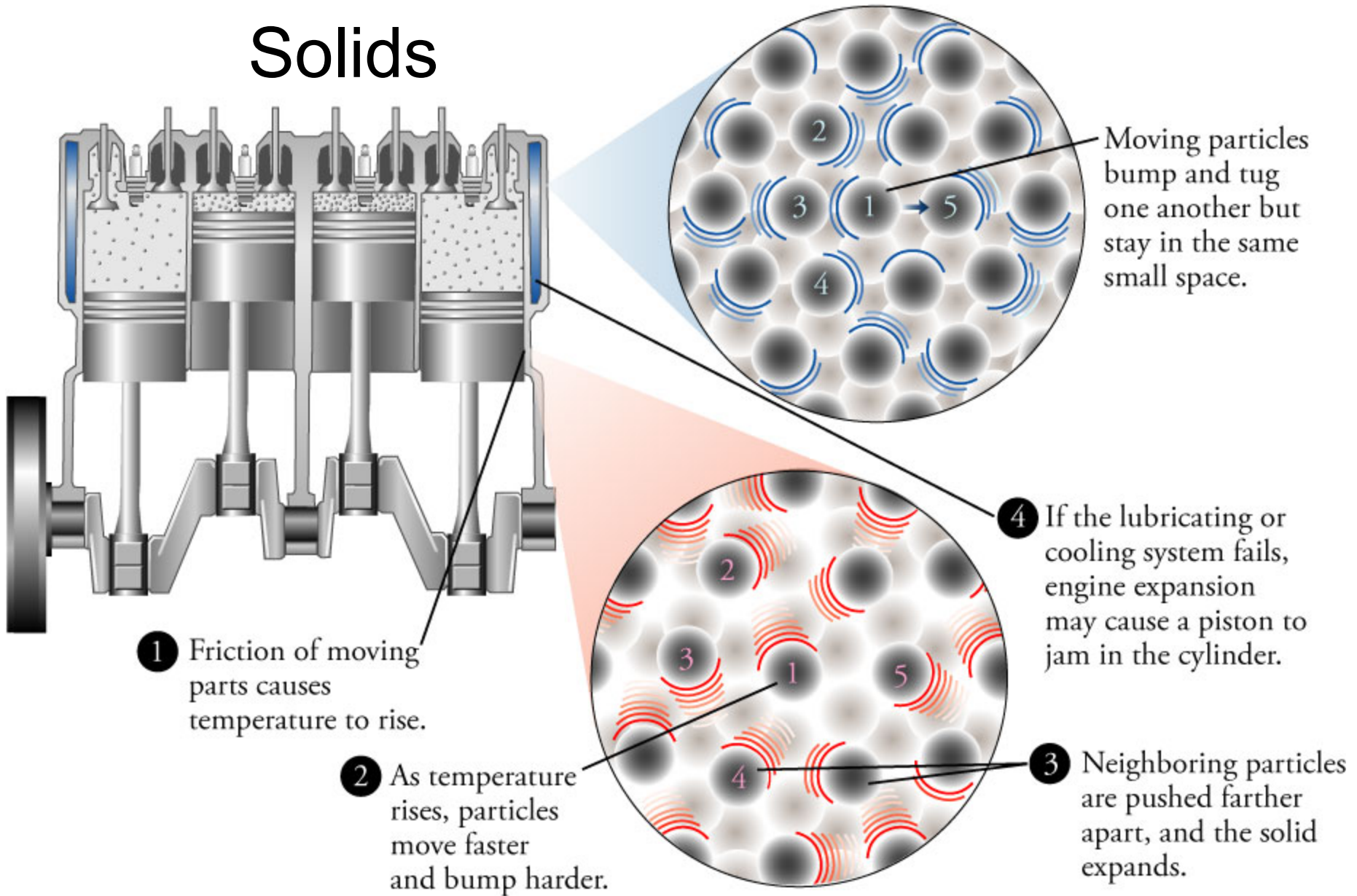
A vertical column of water molecules (H<sub>2</sub>O) is shown on the left side of the slide. Each molecule consists of one red oxygen atom and two smaller black hydrogen atoms. The molecules are arranged in a way that suggests they are packed together, representing the solid state of water (ice).

# Solid

- Constant shape and volume
- The particles are constantly moving, colliding with other particles, and changing their direction and velocity.
- Each particle is trapped in a small cage whose walls are formed by other particles that are strongly attracted to each other.

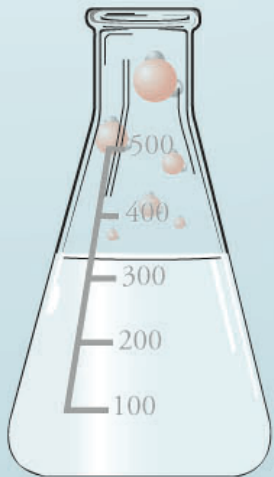


# The Nature of Solids

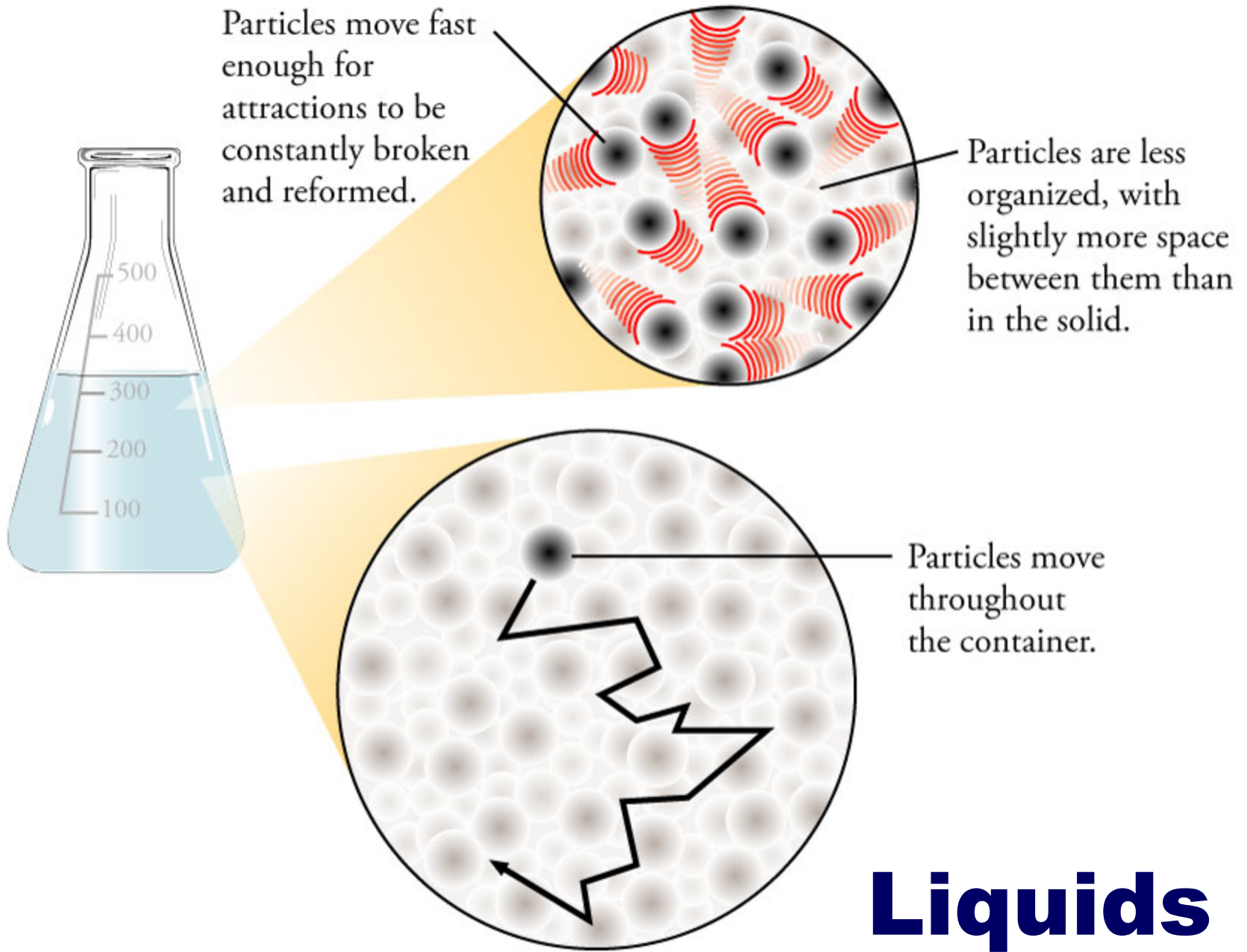


# Liquid

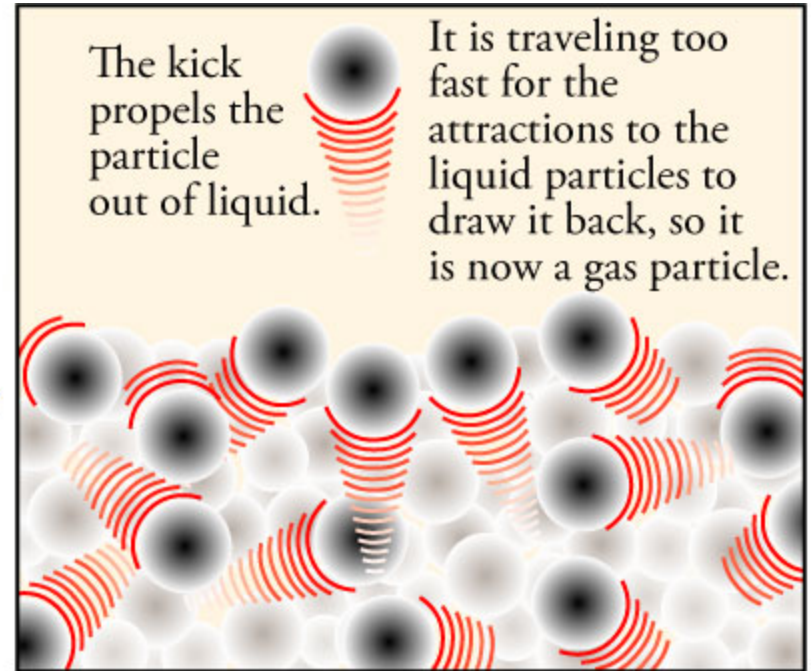
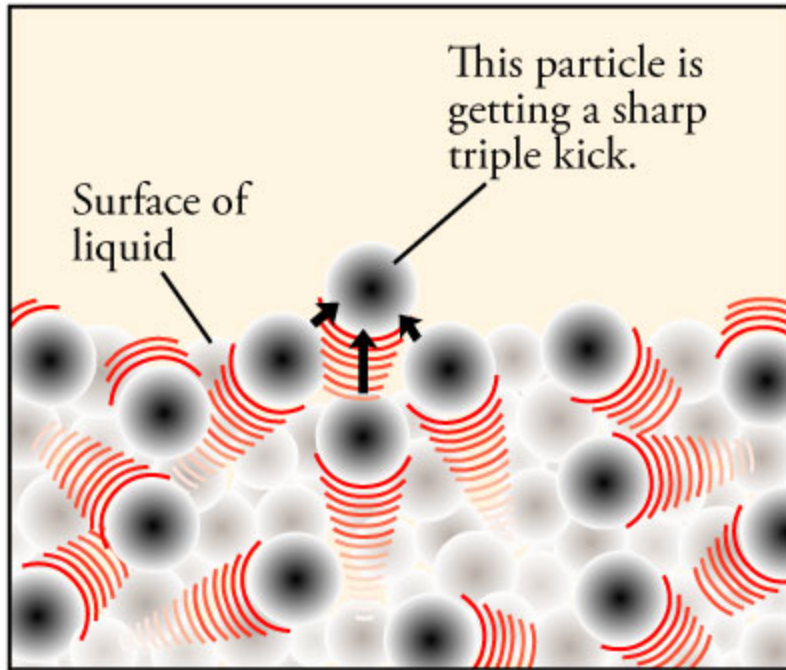
- Constant volume but variable shape
- The particles are moving fast enough to break the attractions between particles that form the walls of the cage that surround particles in the solid form.
- Thus each particle in a liquid is constantly moving from one part of the liquid to another.





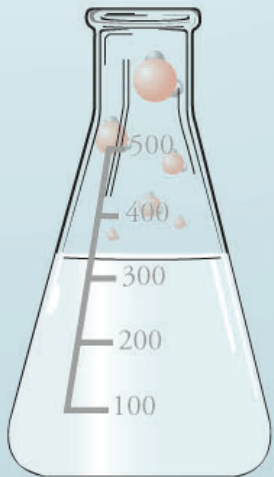


# Evaporation



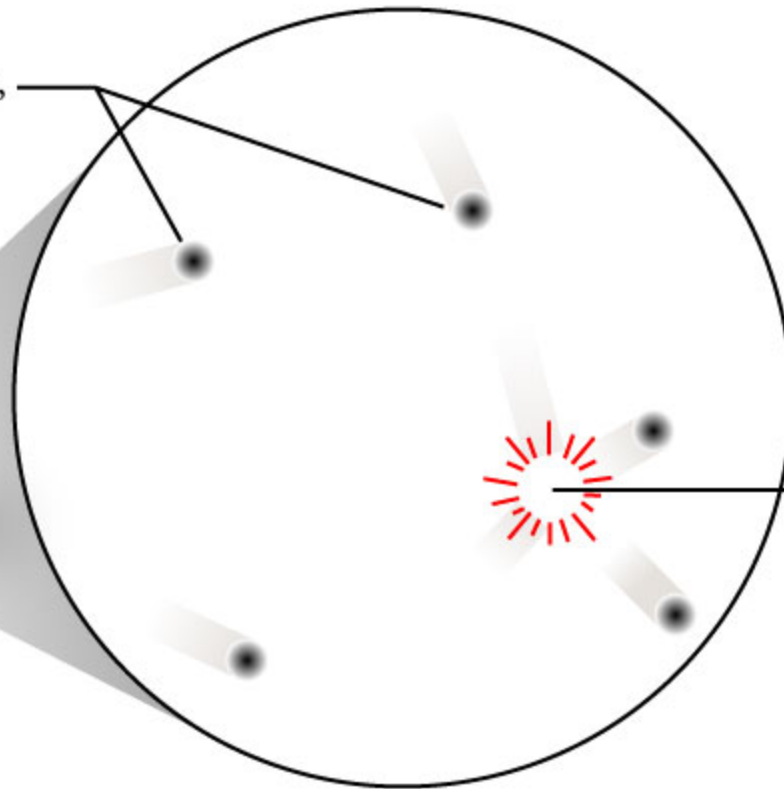
# Gas

- Variable shape and volume
- Large average distances between particles
- Little attraction between particles
- Constant collisions between particles, leading to constant changes in direction and velocity



# The Nature of Gases

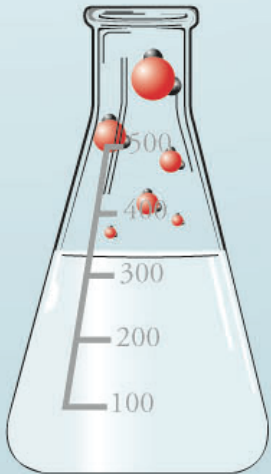
Because particles are so far apart, there is usually no significant attraction between them.



Particles move in straight paths, changing direction and speed when they collide.

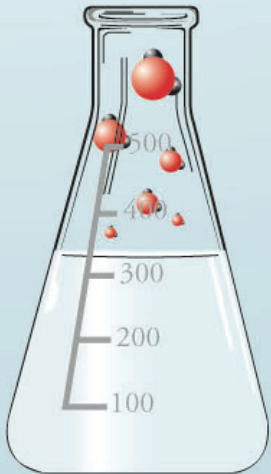
# Description of Solid

- Particles constantly moving.
- Up to 70% of volume occupied by particles...30% empty.
- Strong attractions keep particles trapped in cage.
- Constant collisions that lead to changes in direction and velocity.
- Constant volume and shape due to strong attractions and little freedom of motion.



# Description of Liquid

- Particles constantly moving.
- Up to 70% of volume occupied by particles...30% empty
- Attractions are strong but not strong enough to keep particles from moving throughout the liquid.
- Constant collisions that lead to changes in direction and velocity.
- Constant volume, due to significant attractions between the particles that keeps the particles at a constant average distance, but not constant shape, due to the freedom of motion.



# Description of Gas

- Particles constantly moving in straight-line paths
- About 0.1% of volume occupied by particles...99.9% empty.
- Average distance between particles is about 10 times their diameter.
- No significant attractions or repulsions.
- Constant collisions that lead to changes in direction and velocity.
- Variable volume and shape, due to lack of attractions and a great freedom of motion.
- You can see an animation that shows the particle nature of solids, liquids, and gases at

[https://preparatorychemistry.com/KMT\\_Canvas.html](https://preparatorychemistry.com/KMT_Canvas.html)

