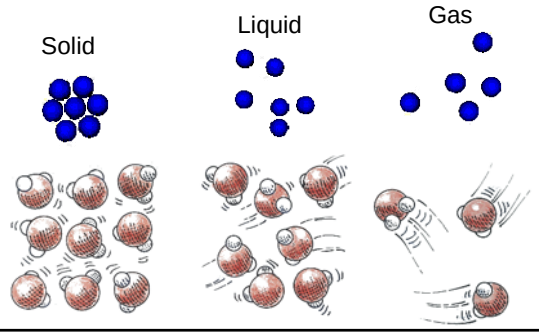
10-1 Kinetic Molecular Theory

Kinetic Molecular Theory – particles of matter are always in motion

Solid Liquid Gas



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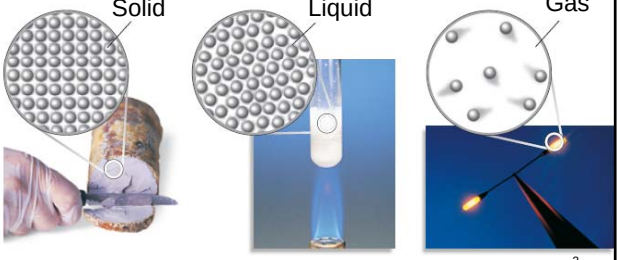
Higher Temperature

→ Faster Particles

→ Farther Apart

Solid Liquid Gas



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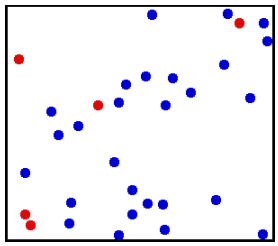
10-1 Kinetic Molecular Theory of Gases

Ideal Gas – an imaginary gas that perfectly fits all assumptions of the kinetic-molecular theory

Elastic Collision – a collision without any net loss of kinetic energy



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10-1 Kinetic Molecular Theory of Gases

Kinetic Molecular Theory of Gases

1) Gases take up 1000 times the volume of liquid or solid states

2) Collisions between particles and walls are **elastic collisions** (Collisions without any net loss of kinetic energy)

3) Gas particles are in constant, rapid, random motion. The energy from motion is kinetic energy

4) There are no forces of attraction or repulsion between particles

5) The kinetic energy of a gas depends on its temperature. Higher temperatures give higher speed.

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10-1 Kinetic Energy and Particle Speed

$KE = \frac{1}{2}mv^2$

- **All gases at same temperature have same kinetic energy**
- **Gas particle mass does not change**
- **Energy depends on speed**

This causes…
Particles with less mass move faster than heavier particles

Ex. H_2 will move faster than O_2 at the same temperature.

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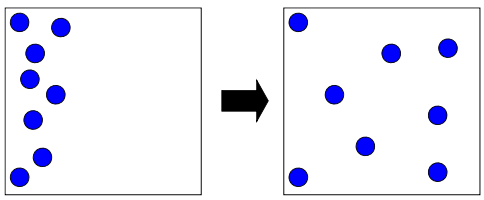
10-1 Nature of Gases

Expansion – gases quickly expand to fill up any container

Fluidity – gas particles (like liquids) flow past each other and are fluids.



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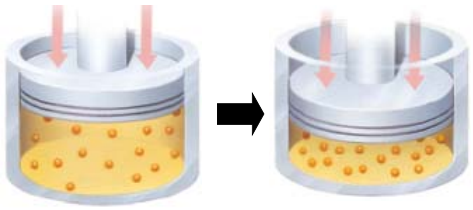
10-1 Nature of Gases

Low Density – density of the gas state is about 1 / 1000th of solid and liquid states

Compressibility – gases can be compressed to a much smaller volume



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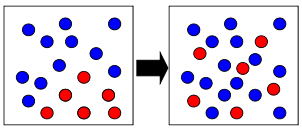
10-1 Nature of Gases

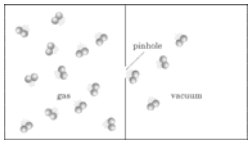
Diffusion – mixing of particles of different gases from random motion. Lighter gases will typically mix faster.

Effusion – gas under pressure flows through a tiny opening (like a hole in a tire) Lighter gases will effuse faster

Diffusion



Effusion



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10-1 Real Gases

Real gas – does not behave completely with kinetic molecular theory

- Real gases will differ from ideal due to attractive forces
  Ex. Polar compounds become less ideal
- Gases become less ideal when tighter packed
  - Lower Temperature
  - Higher Pressures

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