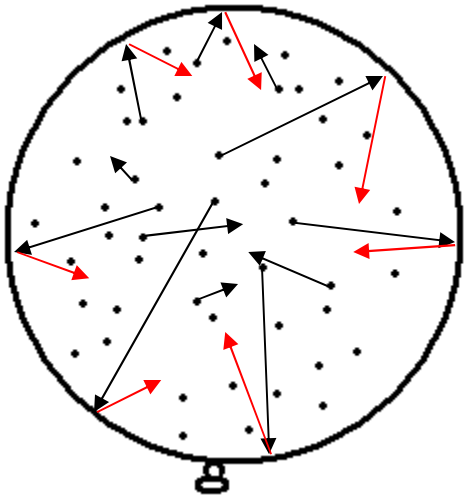
Kinetic Molecular Theory

Microscopic model for real-world gas behavior



Microscopic Model:
Assumptions:

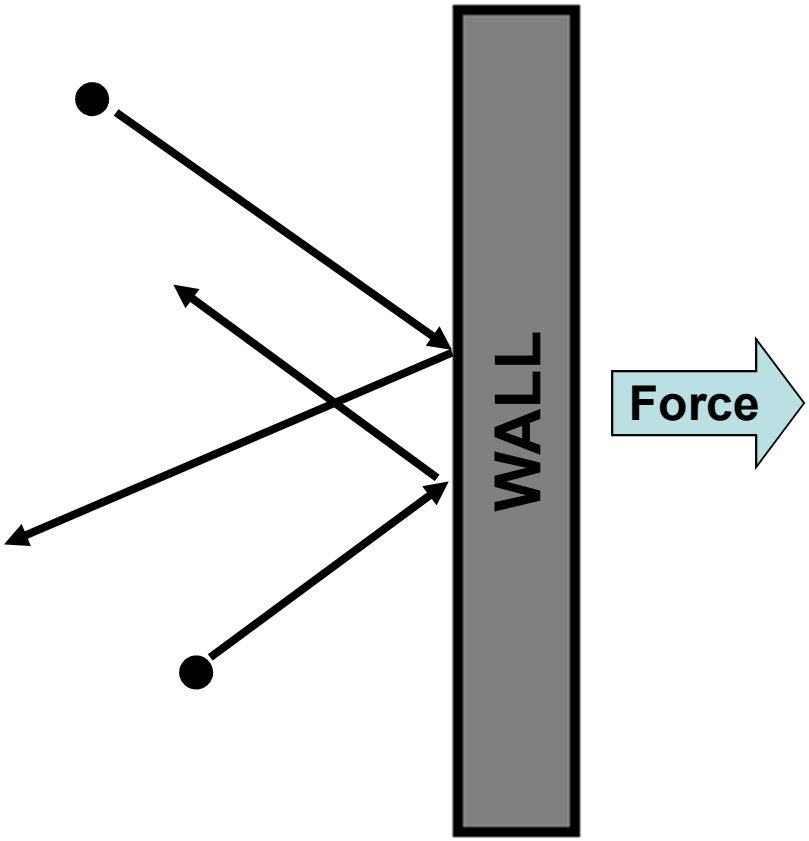
1. Gases contain microscopic particles (atoms and/or molecules).

2. The volume or space the particle occupies isn't significant.

3. Particles move in straight lines until there is a collision.

4. All collisions are elastic, that is no energy is lost.

Collisions Produce Pressure



$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

How can we increase pressure?

1. Increase how often collisions occur.
(i.e. *increase collisional frequency*)

2. Increase the energy of the collisions.

Increase velocity or mass.

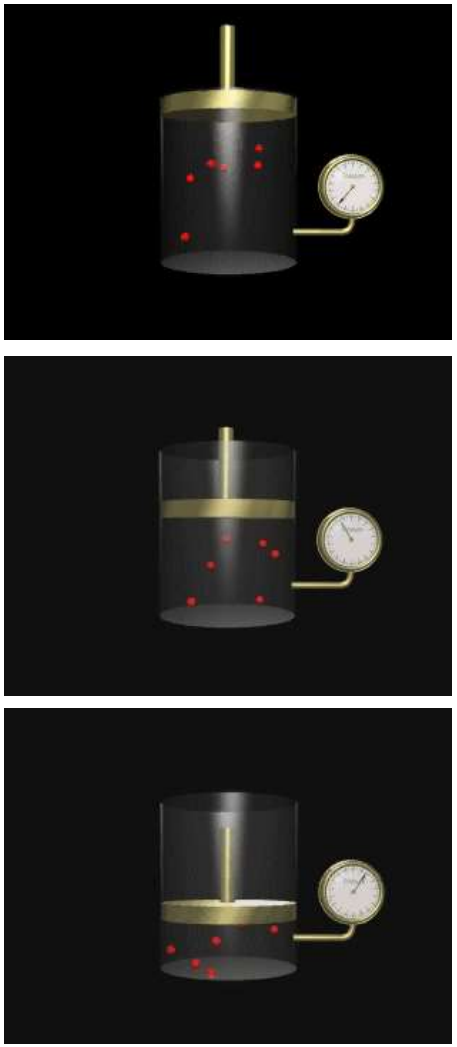
Pressure and Volume...Boyle's Law
$P \times V$ = constant (n & T are constant)

Smaller volume
(No change to n or T)

Collisions occur more often
(Collision frequency increases)

Greater pressure

Click on any right photo and view 5.10: Microscopic Boyle's Law movie.



http://leung.uwaterloo.ca/CHEM/120/CINEMA.htm

Volume and Temperature (Charles' Law)... V/T = constant (P & n fixed)

Increase the gas temperature

↓

Increase the particle velocities

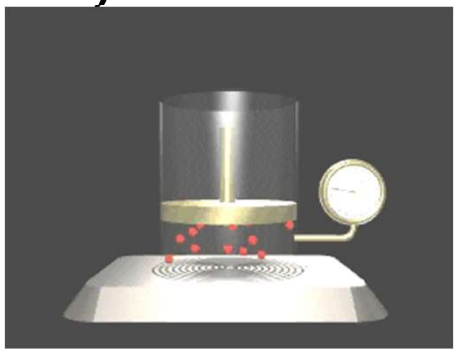
↓

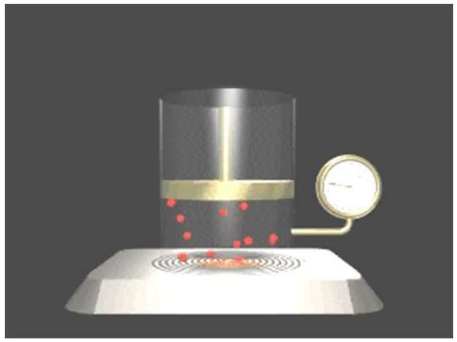
Increase the K.E. of the particles
(particles strike with more force)

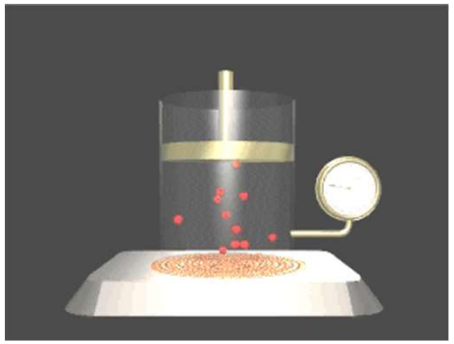
Collisions occur more often
(Collision frequency increases)

→ **Volume increases**

Click on any photo and view 5.11: Microscopic Charles' Law movie.







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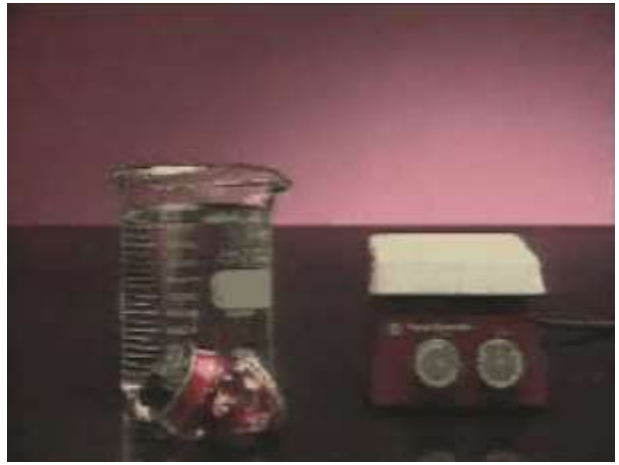
Volume and Temperature (Charles' Law)... V/T = constant (P & n fixed)







http://leung.uwaterloo.ca/CHEM/120/CINEMA.htm

For a continuous quick time movie, click on any photo above and click on 5.12: Collapsing Can.

What affects the K.E. of Molecules?

$$K.E. = \tfrac{1}{2} mv^2$$

Change the Mass

...or...

Change the Velocity

Less K.E.

55 mph

More K.E.

Less K.E.

More K.E.