

# Kinetic Molecular Theory & Gases



<http://7-themes.com/6948173-disney-up-movie.html>

## Outcome:

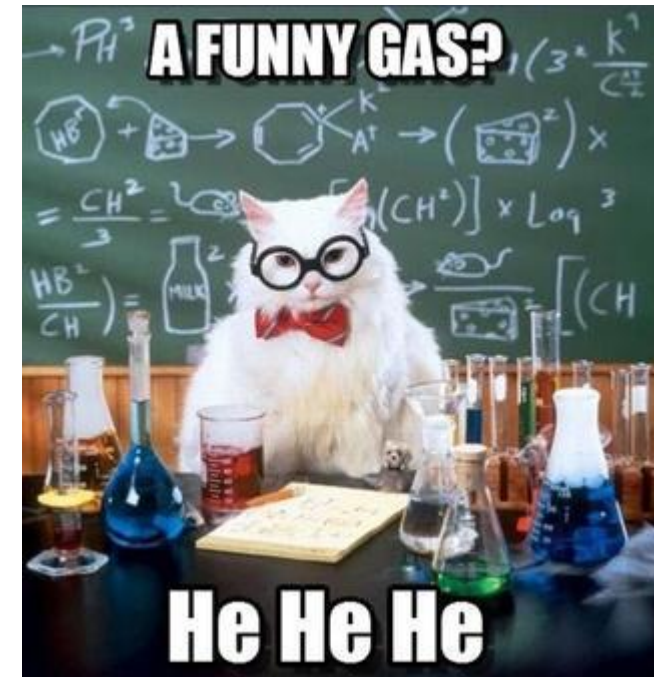
Use the KMT to explain properties of gases. *Include: random motion, intermolecular forces, elastic collisions, average kinetic energy, and temperature.*

# Properties of Gases:

1. *Gases have mass*
2. *Gases are compressible*
3. *Gases fill their container completely*
4. *Gases move through each other easily (diffusion)*
5. *Gases exert pressure*
6. *Pressure of a gas depends on temperature*

These properties of gases have been explained by the

*Kinetic Molecular Theory (KMT).*



# Kinetic Molecular Theory of Gases:

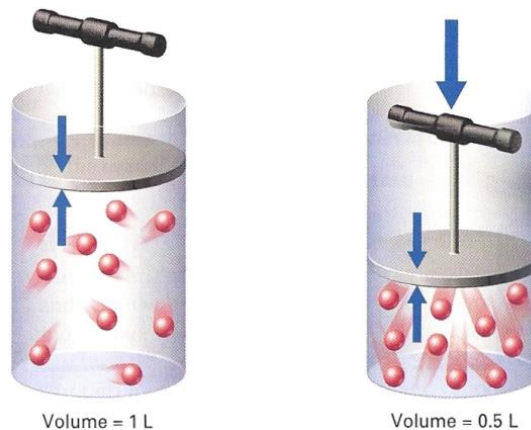
## 1. A gas is made of very small particles, which have mass...

- Compare the masses of an INFLATED and DEFLATED BASKETBALL.



## 2. Gas particles are very far apart...

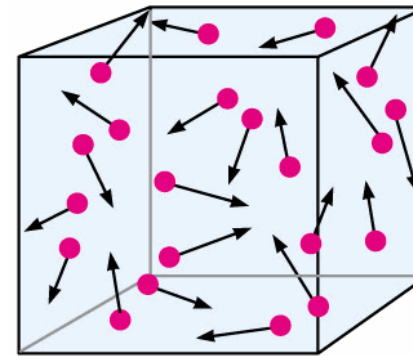
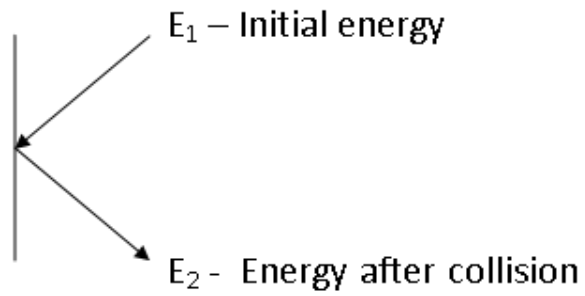
- Particles of a gas are so far apart that the SIZE of the particle is NEGLIGIBLE.
- This is why gases are COMPRESSIBLE.



# Kinetic Molecular Theory of Gases:

## 3. Gas particles are in constant, rapid, random motion...

- This motion results in **COLLISIONS** between **PARTICLES** and the **CONTAINER**, resulting in **PRESSURE**.
- A particle collides with a container wall:



<http://mrdchemawiki.wikispaces.com/The+Gas+Laws>

Three options are possible:

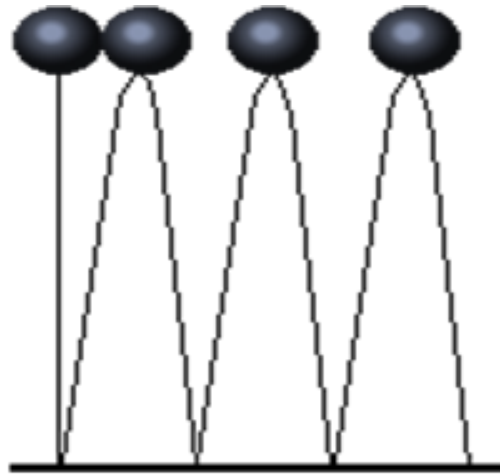
- $E_1 > E_2$  - **Pressure would drop (energy loss)**
- $E_1 < E_2$  - **Pressure would rise (energy gain)**
- $E_1 = E_2$  - **Pressure remains constant**

# Kinetic Molecular Theory of Gases:

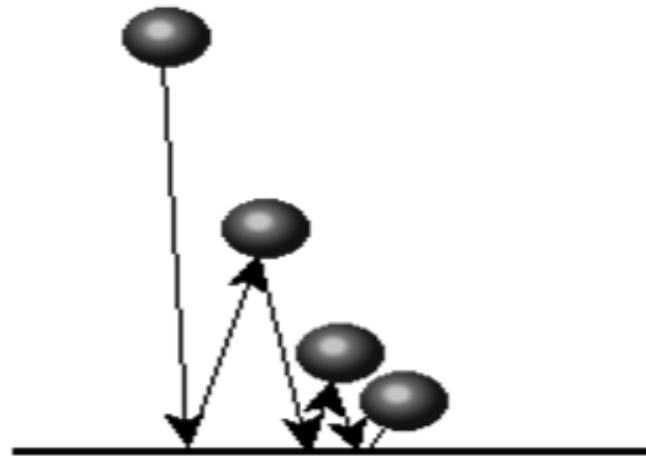
## 4. Collisions involving gas particles are perfectly elastic...

- **NO ENERGY** is **LOST** when gas particles collide, unlike a bouncing ball.
- This allows the **PRESSURE** to **REMAIN CONSTANT** under **CONSTANT TEMPERATURE** (ex. propane tank)

Elastic Collisions



Inelastic Collisions

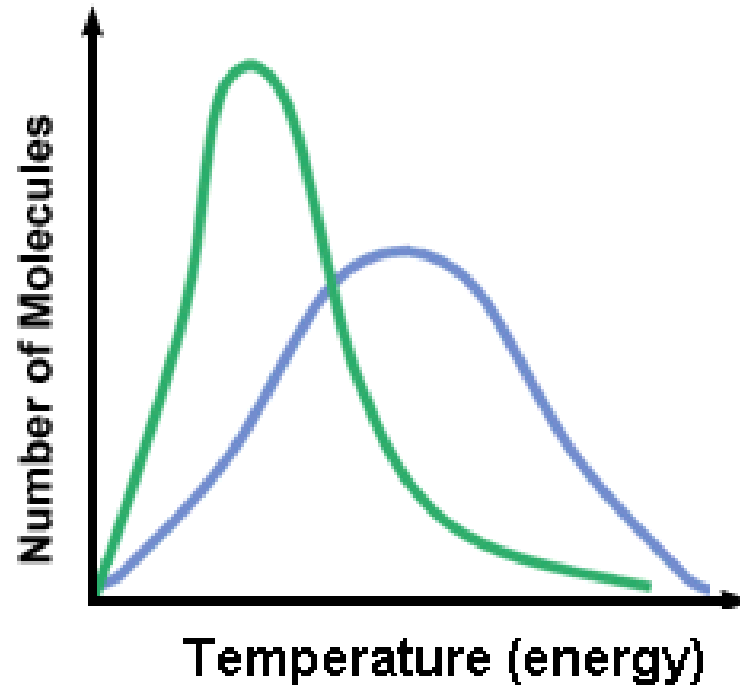


# Kinetic Molecular Theory of Gases:

## 5. The average kinetic energy of gas particles depends ONLY on temperature...

- The **HIGHER** the **TEMPERATURE**, the **HIGHER** the **KINETIC ENERGY** of the gas particles.
- Recall, since mass is constant, then the **VELOCITY** of particles must **INCREASE WITH TEMPERATURE**.
- This can be shown using a Maxwell-Boltzmann distribution:

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



# Kinetic Molecular Theory of Gases:

## 6. Gas particles exert no forces on each other...

- Unlike solids and liquids, gases are said to have **NO INTERMOLECULAR FORCES** holding them together.
  - *There are forces, but the particles are moving so fast that they overcome them*

