N31-B

Crash Course on Gases and their Behaviors

Link to YouTube Presentation: https://youtu.be/r7fBT_DJPsk

- **Many middle school science classes cover gas behavior in pretty decent depth because it is something that is engaging to young students, and something they can understand!**

- **Since may people have learned these concepts before, we are not going to make this an official set of lecture notes. It is available as a refresher, or for those of you who maybe didn’t learn it in middle school.**

- **As always…come see me if you need help! If you need me to explain these concepts in more detail just ask! I am happy to help! ☺**

What exactly causes gas pressure?

Gas particles zoom around REALLY fast!

Helium

3,000 miles per hour

Air (oxygen + nitrogen)

1,000 miles per hour

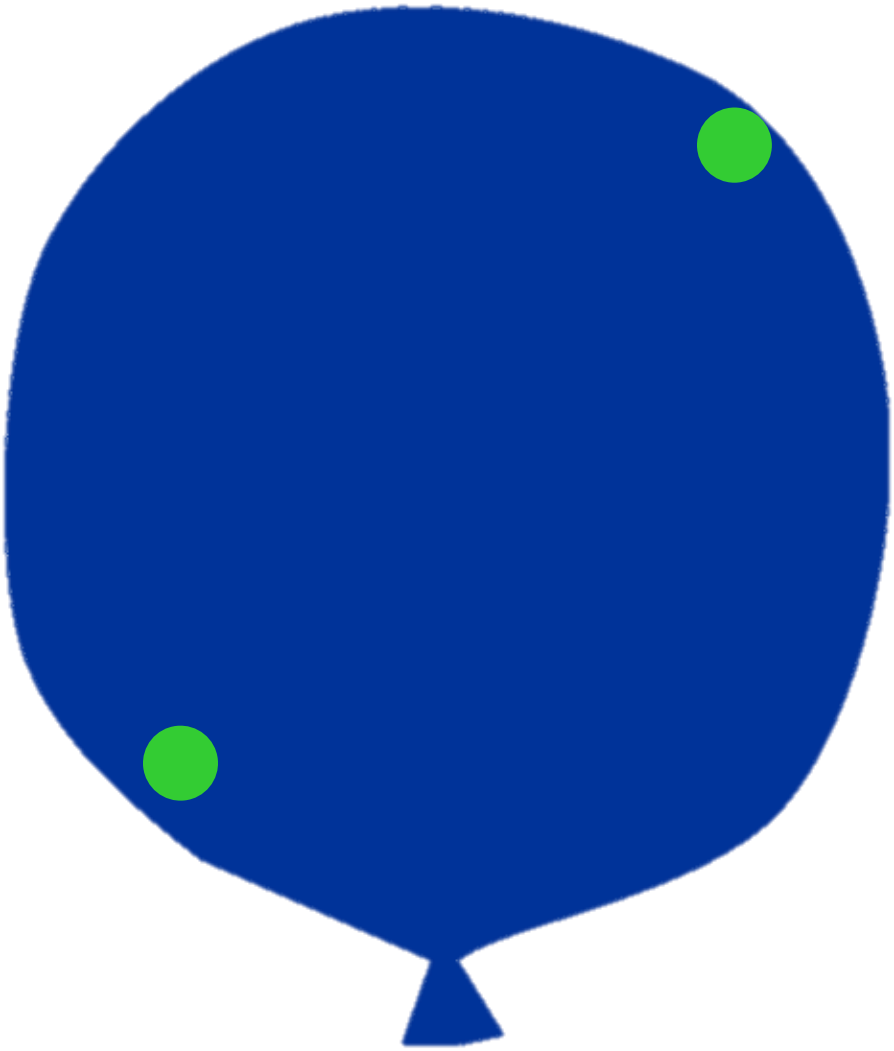
7,000,000,000

collisions per second

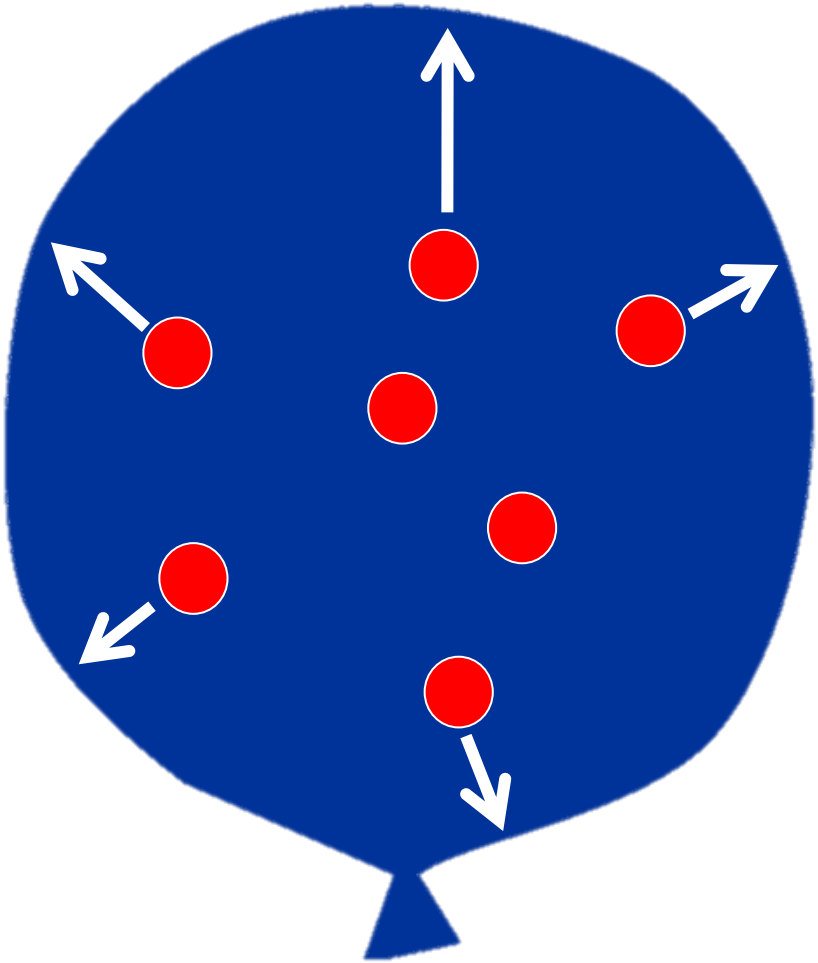
Pressure comes from the gas particles not having anywhere to go.

They hit the edges of the container, and push on it...

Causes Pressure!



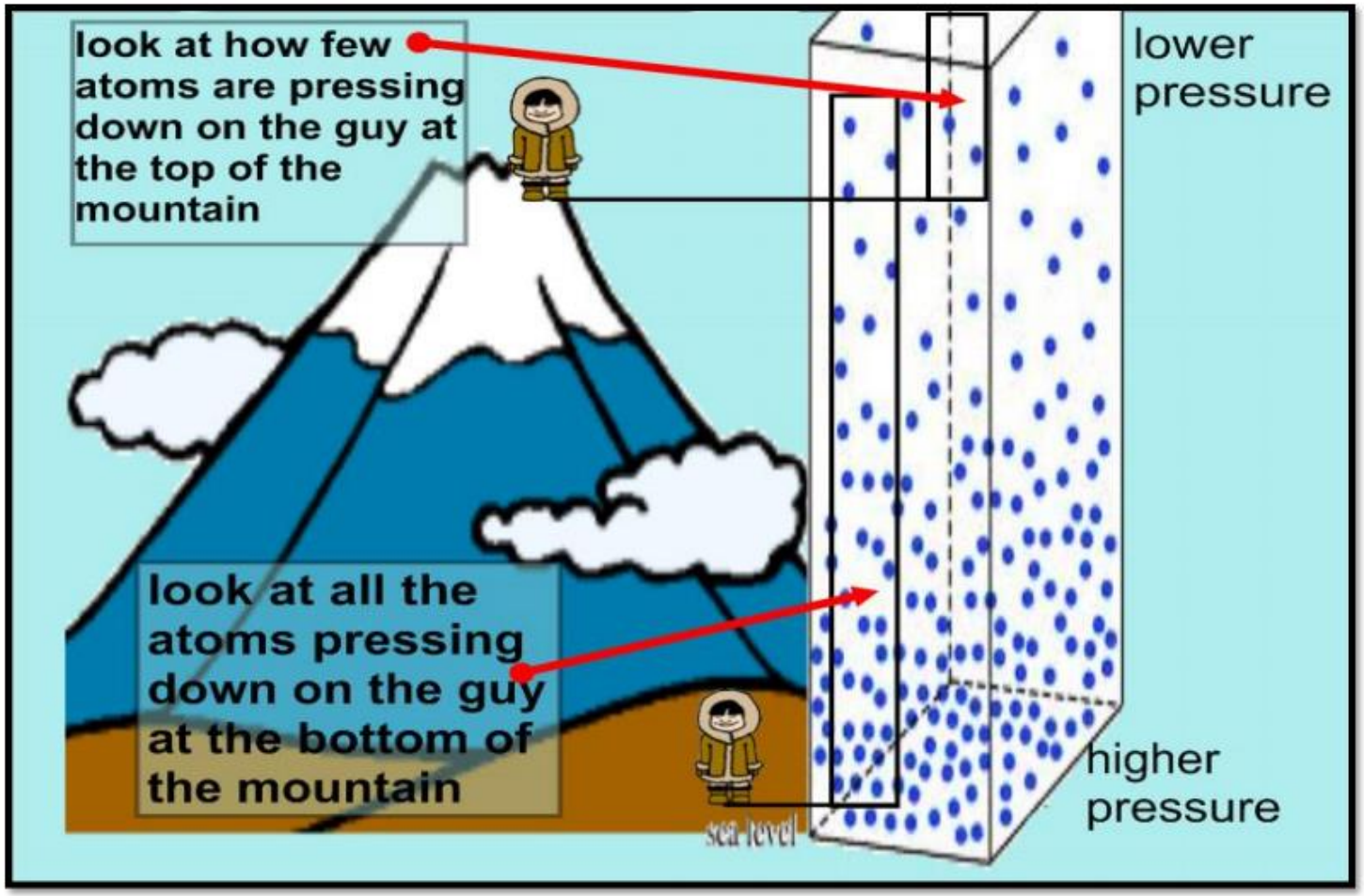
Gas Pressure



We experience pressure due to the atmosphere!

At sea level and 0°C the air molecules exert a pressure of 1 atm (1.03 kg/cm^2)

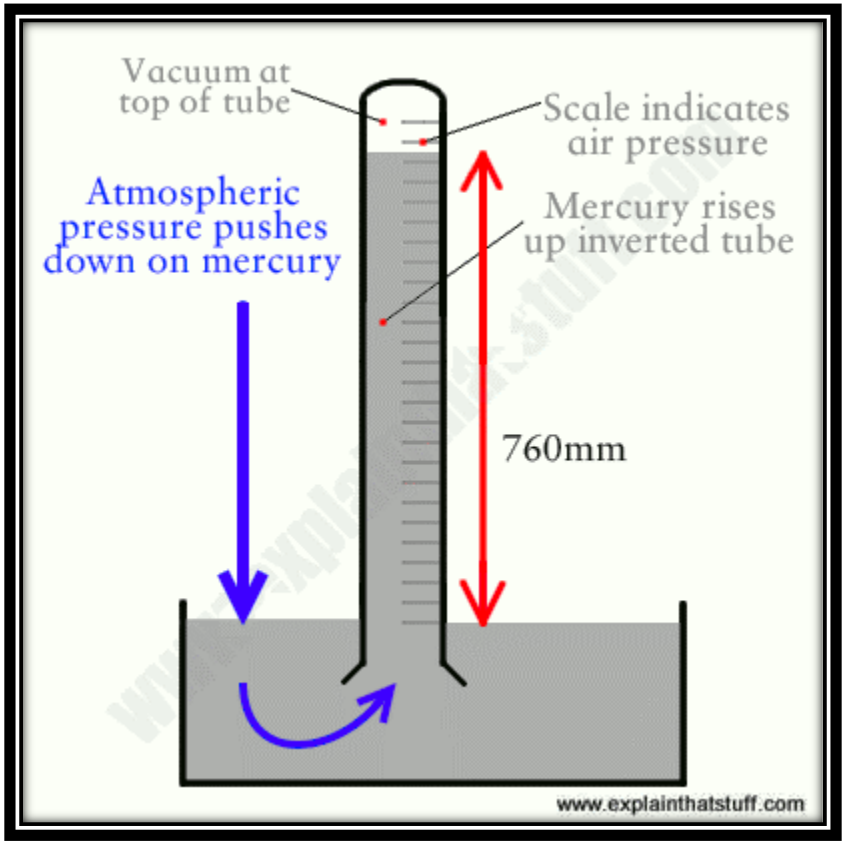
We experience pressure due to the atmosphere!



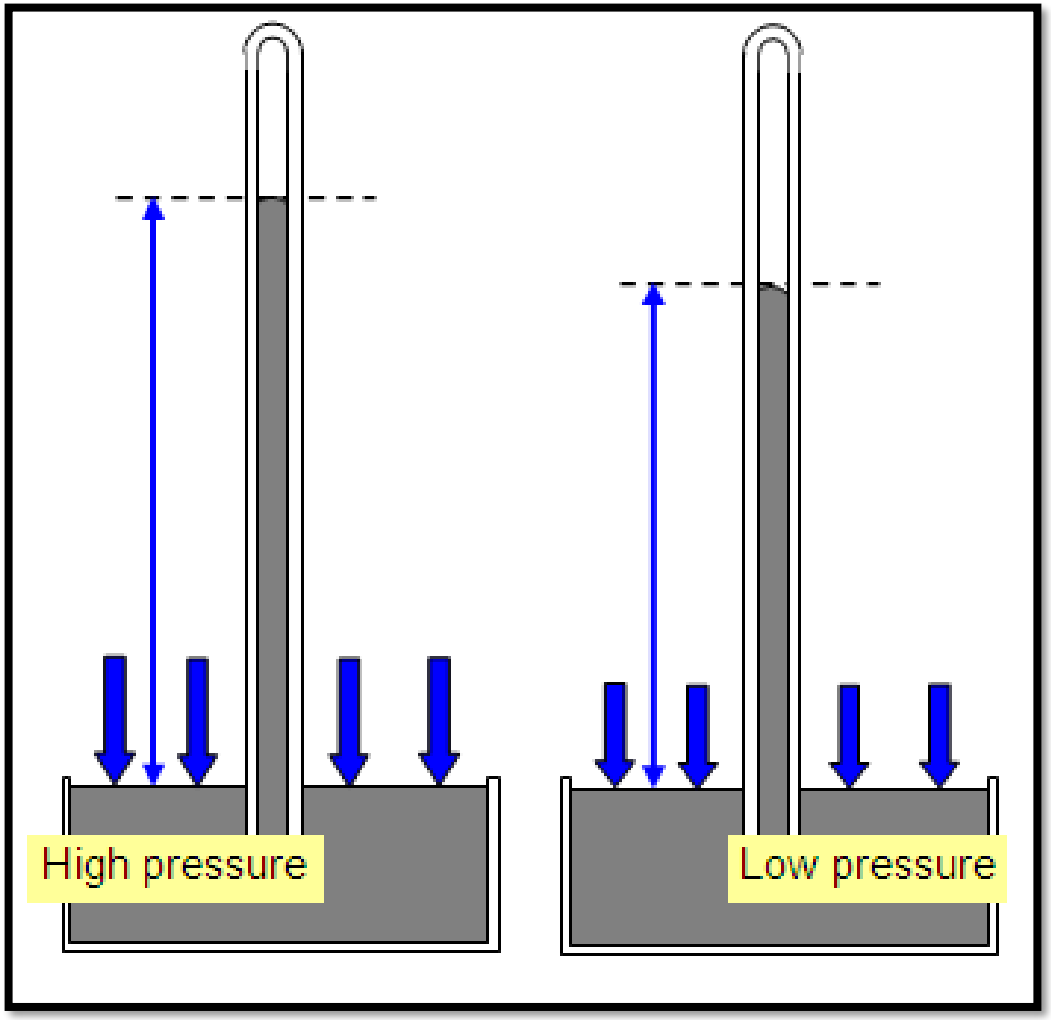
Units of Pressure

Unit	Symbol	Definition/Relationship
Pascal	Pa	SI Unit of pressure
Millimeter of mercury	mm Hg	How much pressure it takes to hold up a 1 mm column of mercury in a barometer.
Torr	torr	1 torr = 1 mm Hg
Atmosphere	atm	Average atmospheric pressure at sea level and 0°C 1 atm = 760 mm Hg = 760 torr = 1.01325×10^5 Pa = 101.325 kPa = 14.700 psi
Pound per square inch	psi	1 psi = 6.89286×10^3 Pa 1 atm = 14.700 psi

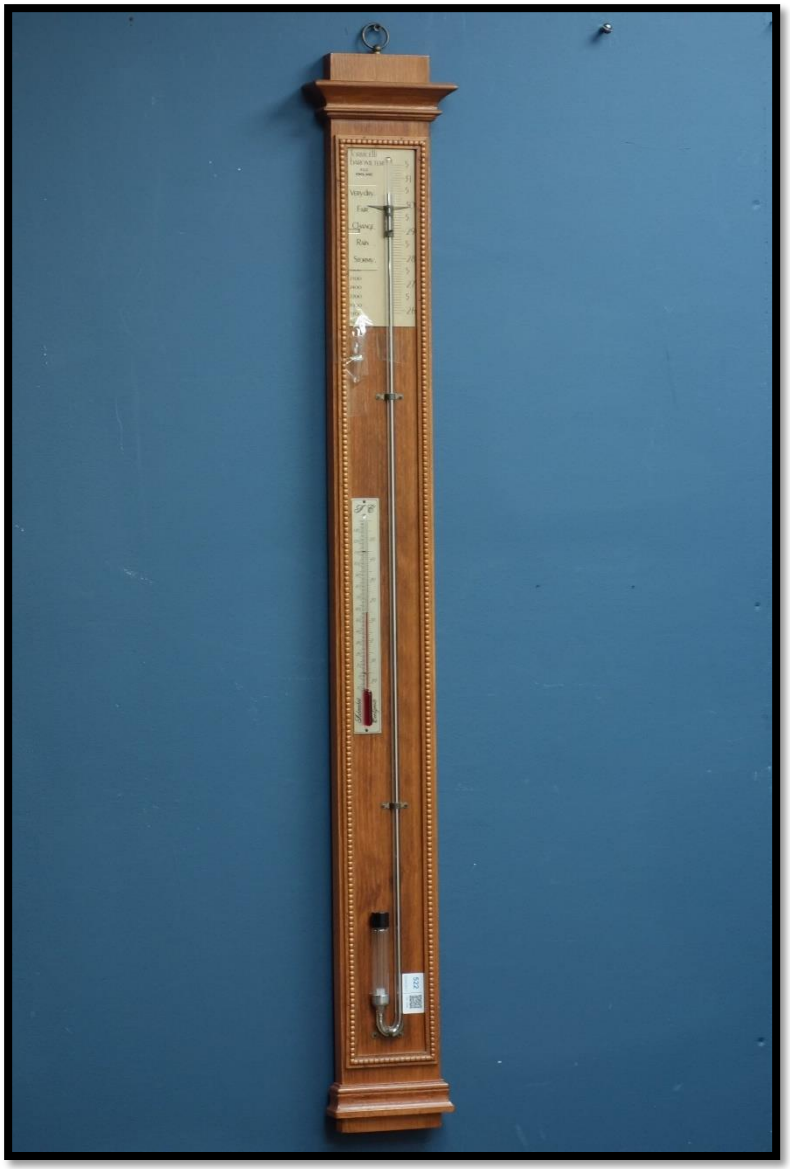
Barometer


Vacuum at top of tube
Scale indicates air pressure
Atmospheric pressure pushes down on mercury
Mercury rises up inverted tube
760mm
www.explainthatstuff.com

Barometer



Barometer



Kinetic Molecular Theory

“KMT Theory”

Based on the idea that particles of matter are always in motion

The Kinetic Molecular Theory applies to what type of gases?

IDEAL GASES

A hypothetical gas that follows all the rules of KMT

- **Doesn't really exist!!!**
- **Allows us to estimate a lot of things, but they are not exactly real**

REAL GASES can behave like ideal gases, but only under certain conditions

- **High temperature**
- **Low pressure**
- **Best to be low IMFs, nonpolar**

5 assumptions of KMT

1) **Gases consist of large #s of tiny particles that are far apart relative to their size**
   - Most of the volume if a gas is empty space.
   - Gas particles themselves, are so small they don't actually have a "volume"
   - Gas particles are further apart than in a solid or a liquid

2) Collisions between gas particles and between particles and container walls are *elastic collisions*

- When two molecules collide with each other, they transfer their kinetic energy, but they don't lose any energy overall.

3) Gas particles are in continuous, rapid, random motion. They therefore, possess kinetic energy, which is energy of motion.

- They move in all random directions, non-stop

4) There are no forces of attraction between gas particles

- They behave like billiard balls

5) The temperature of a gas depends on the average kinetic energy of the particles of the gas.

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

↑Temperature = ↑velocity = ↑kinetic energy

Properties of Gases

1) Expansion

- No definite shape or volume
- They expand to fill the container they are in

2) Fluidity

- There are no attractive forces between particles, so they glide/flow past each other

3) Low Density

- They are very far apart so they have a low density

4) Compressibility

- Because the molecules are far apart, they can be compressed/squished closer together

5) Diffusion

- Gas particles fly around and mix together

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