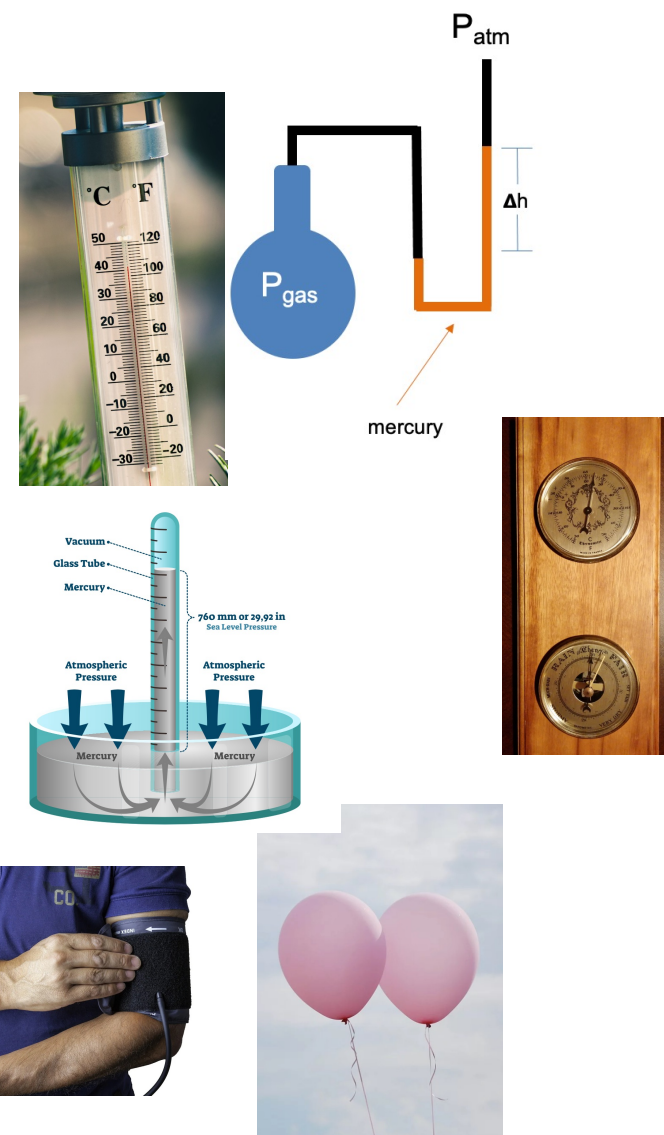


Introduction to Gases

- Properties of Gases
- Forces Between Particles
- Kinetic Energy and Molecular Theory
- Units of Pressure
 - Pascals, Bars, Atmospheres, Pounds per Square Inch
- Weather and Pressure
- Measuring Pressure
- Barometer and Manometer
- Kelvin Temperature Scale and Absolute Zero
- Standard Ambient Temperature and Pressure



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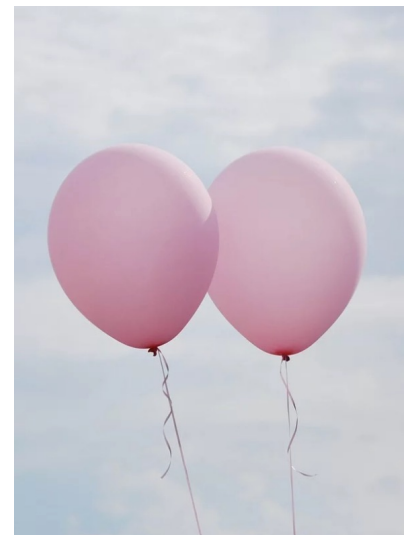
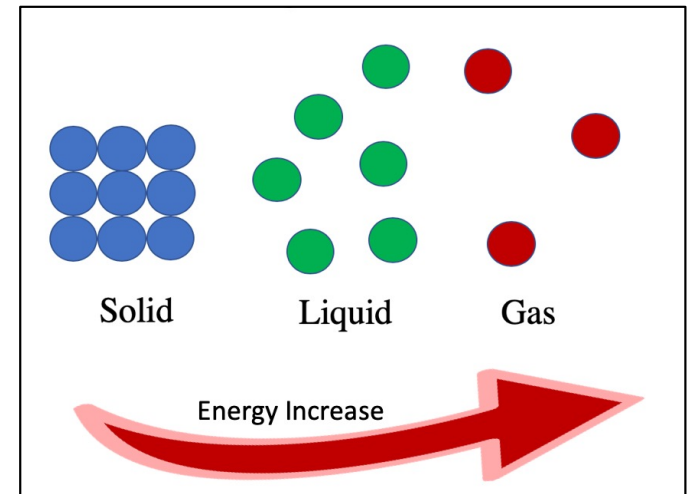
- Some slides appear blank because they have been removed
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- Other slides may have on them, this represents writing that has been removed on this sample

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Properties of Gases

- _____
- Low density
- Most are colorless and odorless
- Volumes change dramatically with changes in pressure & temperature
- Gases can be mixed in any proportion to give a homogenous solution



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Forces Between Particles

- Intermolecular forces are one of the determining factors of a substance's state of matter
 - The stronger the force, the more energy required to pull or break the attraction between particles
- Particles with the strongest attractive forces tend to be solid
- _____

Kinetic Energy

- _____
 - This means that there is always motion
- However, the type of motion varies depending on the state of a substance
 - For example: particles in a solid will have vibrational motion. It will move back and forth about a fixed position.
- _____
 - _____

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Kinetic Molecular Theory

1. The particles move in rapid, straight-line motion between collisions with one another and with the walls of its container.
2. The volume of particles is negligible compared to the volume of the container. Therefore, a sample of gas is mostly empty space.
3. _____
4. There is no loss of energy when two particles collide.
5. At any given temperature, the average kinetic energy of the particles in all gases is the same.

Kinetic Molecular Theory

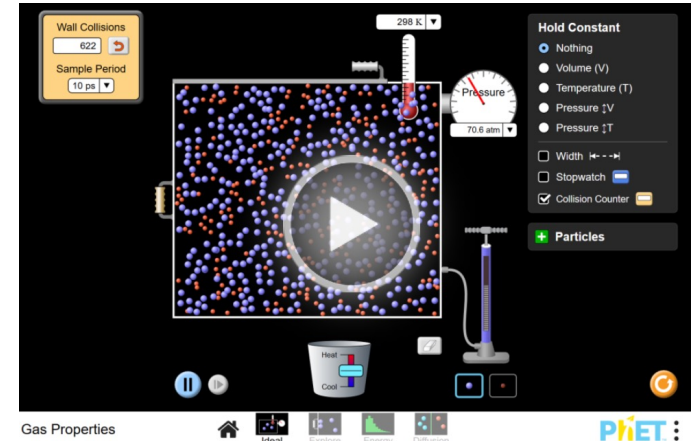
- This theory explains the behavior of gases. It is based on a hypothetical substance referred to as an ideal gas
- _____
- _____
- This theory describes behaviors of gases at ideal temperatures and pressures
- The

Pressure

$$\text{SI Unit: Pa} = \frac{\text{N}}{\text{m}^2}$$

- A Newton is a unit of force
- Pressure is the force/Area

Click the image in slideshow mode to try the simulation

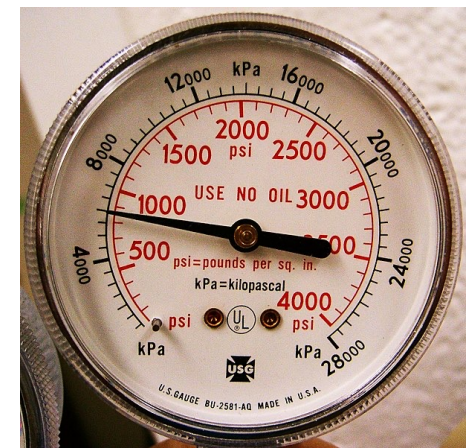


The more particles, higher the temperature (faster molecules) or smaller the container the more pressure there will be.

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Units of Pressure - Pascals

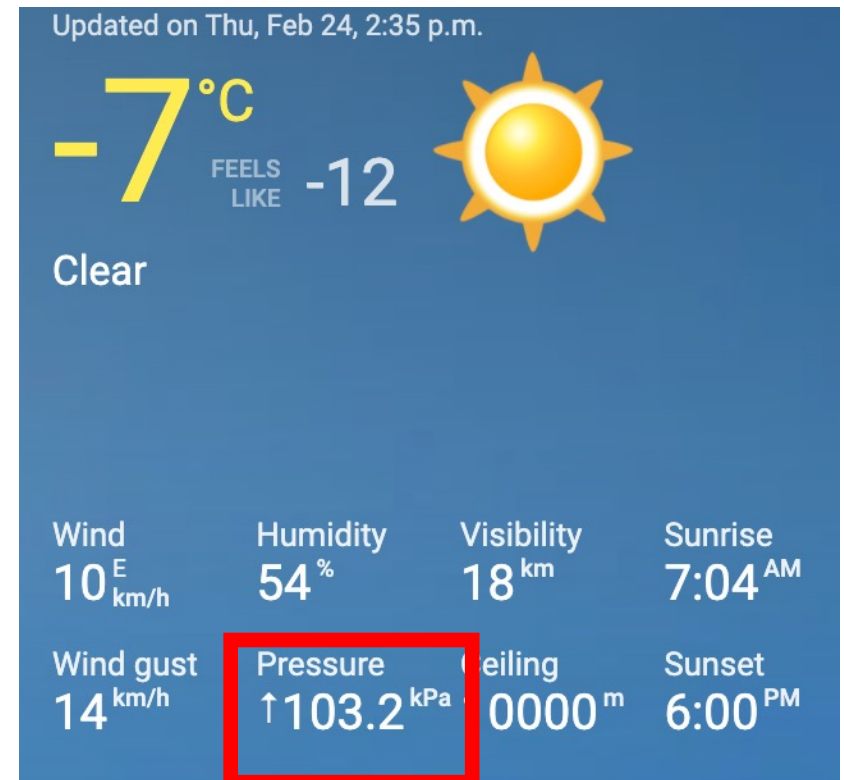
- Pascals (Pa) - SI = International System of Units
- Very small unit
-



Weather and Pressure

Atmospheric/Barometric Pressure

The force per unit area exerted by the weight of the atmosphere above a point on or above the earth's surface.



Weather and Pressure

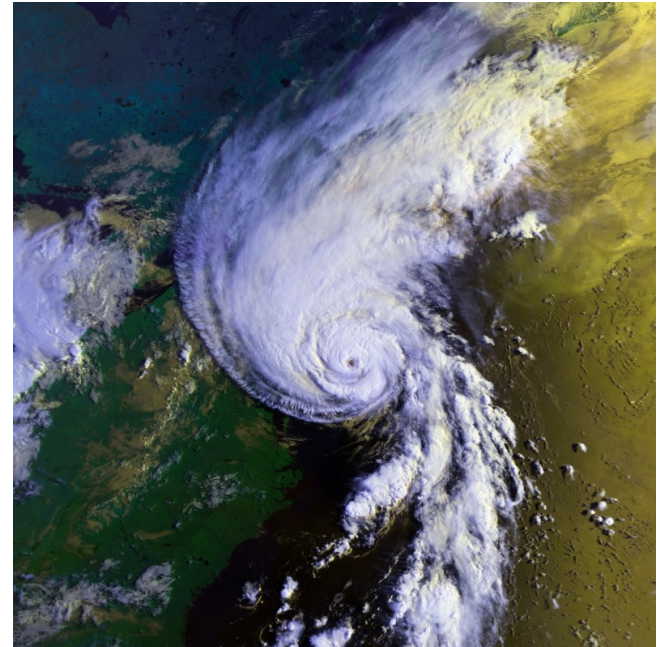
- In general, the pressure at the surface is high because of descending air
- _____
- Less clouds and heated air generally leads to clearer skies
- Severe
- Average atmospheric pressure at sea level is about 101.3 kPa



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Units of Pressure - Bars

-
- Meteorologists also use this one
 - ---



Units of Pressure - Atmospheres

Atmospheres (atm)

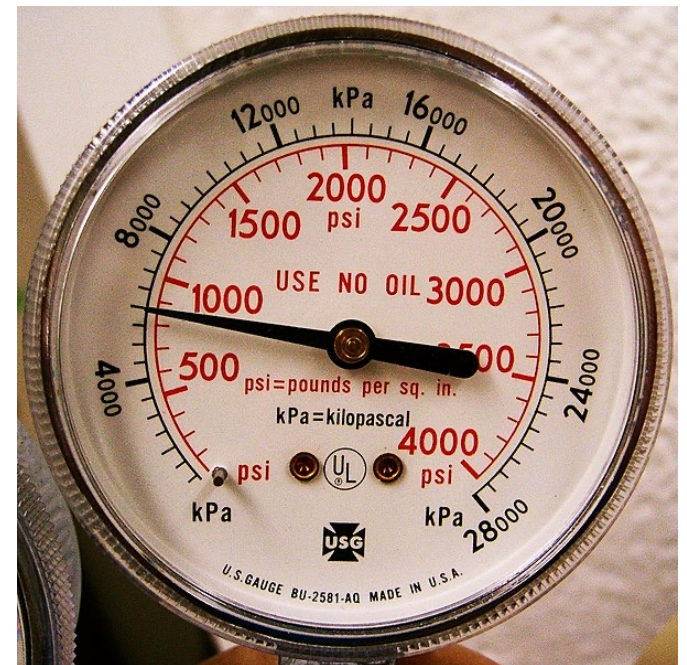
- Sometimes still used to express measurements with high pressures
- $1 \text{ atm} = 760 \text{ mmHg}$
- $1 \text{ atm} = 101.3 \text{ kPa}$
-
- The pressure on Venus = 91 atm
- This would crush you!
- The Sun's atmospheric pressure is 340 billion times that of Earth

Units of Pressure – Pounds per Square Inch

Pounds per Square Inch
(lb/in² or psi)

- Used frequently (i.e., tire pressure)

- _____



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Check Your Understanding

The pressure on the top of Mount Everest is about 253 mm Hg. What is the pressure in units of kilopascals (kPa)?

Given: $P_{\text{mm Hg}} = 253$

Unknown: $P_{\text{kPa}} = ?$

$101.3 \text{ kPa} = 760 \text{ mmHg}$

Measuring Pressure

- Barometer – Measures the pressure of the atmosphere on its surroundings (absolute pressure)

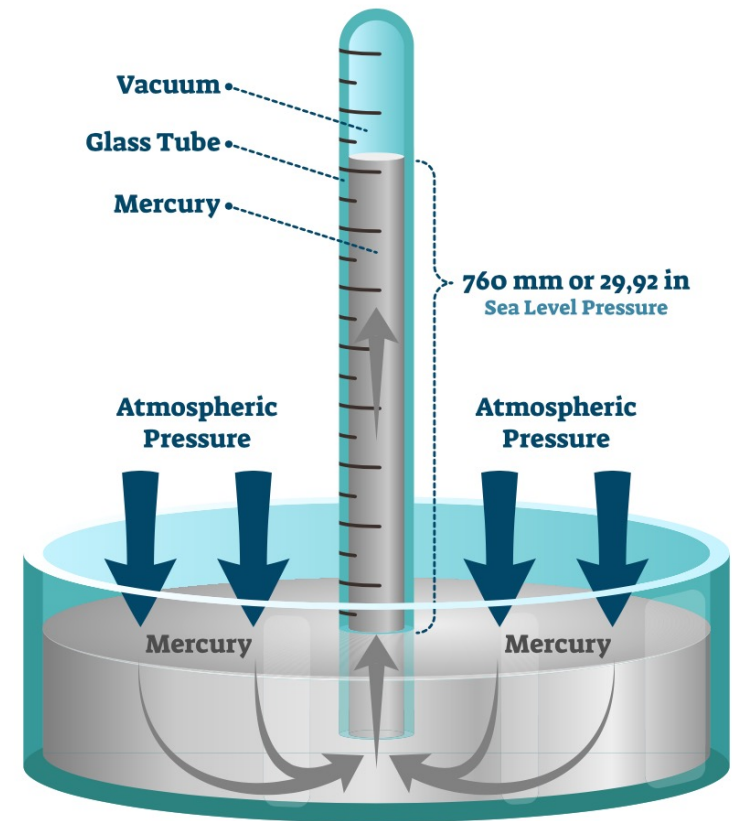
- _____



Barometer

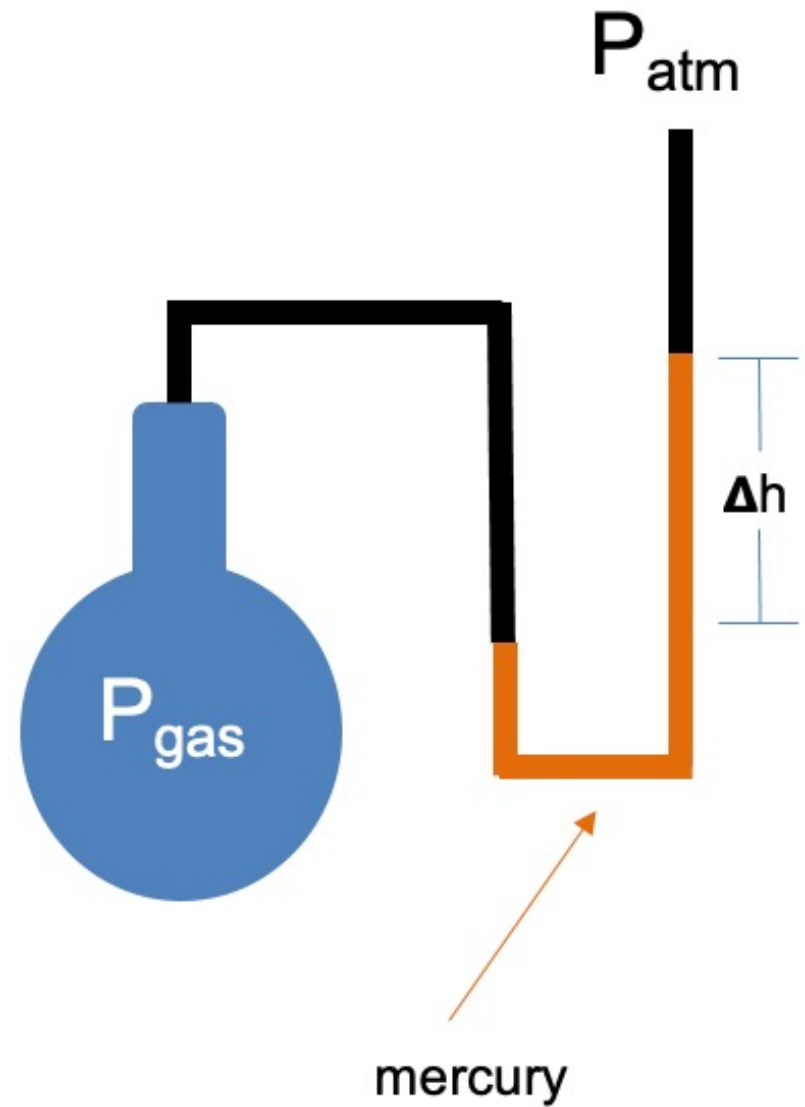
If the atmospheric pressure is high, the liquid in the container is pushed down which causes _____

If the pressure is low, the reverse occurs.



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Manometer



Kelvin Temperature Scale

- As you lower the temperature of a gas, theoretically, enough energy would be drawn from it, that its volume would reach zero because its particles would be so close together
- This would occur at -273°C
- _____
- _____

Absolute Zero

- _____
- Instead of degrees, Kelvins are employed
 $-273^{\circ}\text{C} = 0 \text{ K}$
- An increase in 1-degree Celsius is the same as an increase in 1-degree Kelvin.
- Therefore, 25°C in Kelvin is:
 $(25 + 273)\text{K} = 298 \text{ K}$



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Standard Ambient Temperature and Pressure (SATP)

- Scientists need standard conditions so that measurements in different units and results of experiments can be compared
- _____

Standard Ambient Temperature and Pressure (SATP)

- In the 1970's, SATP was developed and is now more commonly used
- _____
- Both STP and SATP are employed still today (STP for straight gas study, SATP for thermochemistry)