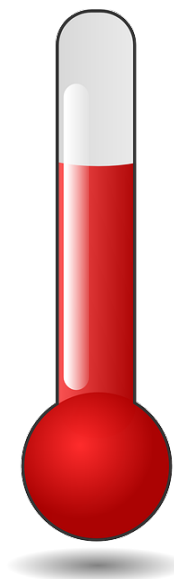


The Ideal Gas Law

- The Ideal Gas Law
 - $PV = nRT$
- Ideal Gas Condition
- Deriving the Ideal Gas Law
- Ideal Gas Law Practice Questions

$$PV = nRT$$



Preview File

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The Ideal Gas Law

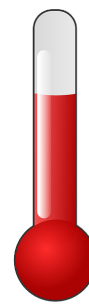
- How can pressure, temperature, and volume be used to find a relationship between the amount of gas (moles) in a sample?
- The ideal gas

$$PV = nRT$$

The Ideal Gas Law – $PV = nRT$

- _____
- Volume (V), given in liters
- Number of moles of gas (n)
- Temperature of the gas (T) measured in degrees Kelvin (K)
- R is the ideal gas constant, which differs depending on the units being used. The three most common formulations of R are given by:

$$8.3145 \frac{\text{L} \cdot \text{kPa}}{\text{K} \cdot \text{mol}} = 0.0821 \frac{\text{L} \cdot \text{atm}}{\text{K} \cdot \text{mol}} = 62.4 \frac{\text{L} \cdot \text{mm Hg}}{\text{K} \cdot \text{mol}}$$



Ideal Gas Conditions

There are four assumptions to make a gas ideal

1. _____

2. _____

3. The gas particles have negligible volume.

4. The gas particles do not have intermolecular forces (attraction or repulsion) with other gas particles.

Deriving the Ideal Gas Law

According to Boyle's Law,

- At constant n & T , the volume has an inverse relation with the pressure exerted by a gas $\rightarrow v \propto \frac{1}{P}$

According to Charles' Law,

- When P & n are constant, the volume of a gas has a direct relation with the Temperature $\rightarrow v \propto T$

According to Avogadro's Law,

- When P & T are constant, then the volume of a gas has a direct relation with the number of moles of gas $\rightarrow v \propto n$

Combining all the three equations, we have $\rightarrow v \propto \frac{nT}{P}$ or $PV = nRT$

Where $R =$

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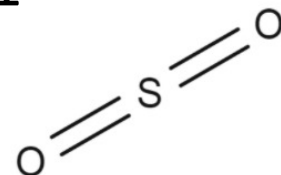
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Where $R =$

Check Your Understanding

A 2.50 L container is filled with sulfur dioxide gas at a pressure of 120 kPa and a temperature of 26°C. Calculate the mass of sulfur dioxide gas in the container. The ideal gas constant is 8.31 kPa•L•mol⁻¹•K⁻¹.



Given:

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Removed**

Check Your Understanding

In the middle layer of the stratosphere the ozone concentration is about 5.0×10^{15} molecules $\cdot$ L $^{-1}$ at a temperature of about -42°C .

What is the pressure in Pa of the ozone under these conditions? The ideal gas constant is $8.31 \text{ kPa}\cdot\text{L}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$.

Given:

Check Your Understanding

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Standard Ambient Temperature and Pressure (SATP)

- _____
- Originally, scientists used Standard Temperature and Pressure (STP), which is 0°C (273 K), and 760 mmHg (1 atm)
- A more commonly used set of condition is SATP which stands for ambient temperature (room temperature) and is defined as 25°C (298 K) and 100 kPa
- Both STP and SATP