1 Gases

1.1 $Pressure = Force/Area$

Pressure exterted by gases is caused by collisions of gas molecules with the walls of their container or with some object. The more frequent and the more forceful, the collision, the greater the pressure.

1.2 Use Boyle's Law to predict ideal gas behavior

Boyle's Law says: at constant temperature, a fixed mass of a gas follows this rule:

$$P_1V_1 = P_2V_2$$

As pressure increases, volume decreases.

1.2.1 Example

$P_1 = 200kPa$
$V_1 = 1.0L$
$P_2 = 400kPa$
$V_2 = ?$

1.3 Use Charles' Law to predict ideal gas behavior

Charles' Law says: At constant pressure, as temperature increases, volume increases for a fixed mass of gas.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

T_1 and T_2 must be in kelvins

1.3.1 Example

A balloon with a volume of $6.0L$ and a temperature of $100K$ is heated to a temperature of $200K$. Calculate its new volume.

1.4 Predict ideal gas behavior using Gay-Lussac's Law

Gay-Lussac's Law says: At constant volume, as temperature increases, pressure increases.

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

T_1 and T_2 must be in kelvins

1.5 Predict gas behavior using the combined gas law

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ for fixed mass of a gas

T_1 and T_2 must be in kelvins

1.6 Apply Avogadro's Law

The volume of a gas mainained at constant pressure and temperature is directly proportional to the # of moles of the gas.

1.6.1 Example

$$2H_2(g) + O_2(g) \rightarrow H_2O(l)$$

Our coefficents for gases at the same temperature and pressure can stand for volume as well as moles.

1.7 Apply the Ideal Gas Law to gas problems

$$PV = nRT$$

P is in kPa, V is in dm^3 or L, n is number of moles, $R = 8.31\frac{kPa \cdot dm^3}{mol \cdot K}$, and T is temperature in Kelvins.

- Standard pressure = 100kPa
- Standard temperature for gases is $273K = 0\ ^\circ C$
- 1 mol of any gas at STP is $22.7dm^3$