Gas Law Notes

Combined gas law- the combination of Charles and Boyle’s law

Charles law- examines the relationship between temperature and volume.

There is a direct relationship between temperature and volume.

(Temp increases-volume increases, temp decreases-volume decreases)

**V1=V2**

**T1 T2**

V= volume (mL,L) T= temperature (K)

Boyle’s law- examines the relationship between pressure and volume.

There is an indirect relationship between pressure and volume.

(Pressure increases-volume decreases, pressure decreases-volume increases)

**P1(V1)=P2(V2)**

Pressure=(KPa, atm) Volume=( mL,L 1000mL=1L)

\*P(V)=K K=constant

Any “x” point multiplied by a “y” point will get the same answer.

These formulas use STP =table A for information

Standard temp= 273K

Standard pressure= 1atm or 101.3kPa

Combined Gas Law

**P1V1 = P2V2**

**T1 T2**

\*\*If Charles law is being used, pressure is held constant (cross out pressure)

If Boyle’s law is being used temperature is held constant (cross out temp)

Partial Pressure (\*\*HONORS ONLY)

When more then one gas is present in a container, each gas exerts a partial pressure. The sum of all the partial pressures is equal tot the total pressure on the sample.

**Ptotal=P1+P2+P3+...etc.**

If a gas is collected over water, the vapor pressure of the water at a given temperature must be taken into account.

Kinetic Molecular Theory(KMT) – REGENTS AND HONORS

\*The conditions at which gases act most ideal(High temperature-low pressure)

Ideal gases(H^2 and He act most ideal)

1. Gas particles are in random straight-lined motion

2. Gas particles collide with each other and the walls of their container. When collisions occur energy is transferred collisions are elastic.

3. Gas particles are separated by relatively large distances therefore their volume is so small it is considered negligible.

4. Gas particles do not attract each other.

Real Gases

\*The conditions at which gases act most real(low temperature-high pressure)

1. Gases move in random straight-lined motion.

2. Collisions are elastic.

3. There can be a small but significant attraction between gas molecules when the particles are very close at low temps.

4. Gases have a small but significant volume

**\*\*Hint: “freeze it, squeeze it is real, the opposite for ideal”\*\***

Avagadros Hypothesis

-When any gas samples are under the same conditions of temperature, pressure and volume, they have the same number of molecules. Remember STP stands for standard temperatureand pressure.

PV=nRT \*Ideal Gas Law\* - HONORS ONLY

P= pressure (atm, kPa)

V= liter (1000mL=1L)

n= # of moles (# mol= given mass/GFM)

R= universal gas constant

T= Kelvin (K= ◦C + 273)

Graham’s Law

The rate of effusion/diffusion of two gases (A and B) are inversely proportional to the square roots of their formula masses. [*It can be a ratio of molecular speeds,*

*effusion /diffusion times, distance traveled by molecules, or amount of gas effused*]



Mole Fraction

The *concentration* of a solution refers to the amount of solute in a given amount of solvent. There are many ways to express, quantatively, the concentration of a solution. Some solution properties depend on the relative amounts of all the solution components in terms of moles. The mole fraction of a solution component Xi is the fraction of moles of component *i* of the total number of moles of all components in solution.

|  |  |  |
| --- | --- | --- |
|  |  | moles of component *i* |
| X*i* | = | ------------------------ |
|  |  | total moles of solution |