NAME: ______________________________

Chapter 14 Reference Sheet

- **Boyle's Law**
  - $V_1P_1 = V_2P_2$
    - V_1 = Initial volume (can be in mL, L, cm^3)
    - V_2 = Final volume (can be in mL, L, cm^3)
    - P_1 = Initial pressure (can be in mm of Hg, atm, kPa)
    - P_2 = Final pressure (can be in mm of Hg, atm, kPa)

$V_1 = \frac{V_2P_2}{P_1}$ $P_1 = \frac{V_2P_2}{V_1}$

$V_2 = \frac{V_1P_1}{P_2}$ $P_2 = \frac{V_1P_1}{V_2}$

- **Charles' Law**
  - $V_1T_2 = T_1V_2$
    - V_1 = Initial volume (can be in mL, L, cm^3)
    - V_2 = Final volume (can be in mL, L, cm^3)
    - T_1 = Initial temperature (**must be in Kelvins!**)
    - T_2 = Final temperature (**must be in Kelvins!**)

$V_1 = \frac{T_1V_2}{T_2}$ $T_1 = \frac{V_1T_2}{V_2}$

$V_2 = \frac{V_1T_2}{T_1}$ $T_2 = \frac{T_1V_2}{V_1}$

- **Gay-Lussac's Law**
  - $P_1T_2 = P_2T_1$
    - T_1 = Initial temperature (**must be in Kelvins!**)
    - T_2 = Final temperature (**must be in Kelvins!**)
    - P_1 = Initial pressure (can be in mm of Hg, atm, kPa)
    - P_2 = Final pressure (can be in mm of Hg, atm, kPa)

$T_1 = \frac{P_1T_2}{P_2}$ $P_1 = \frac{T_1P_2}{T_2}$

$T_2 = \frac{T_1P_2}{P_1}$ $P_2 = \frac{P_1T_2}{T_1}$

- **Combined Gas Law**
  - $V_1P_1\ T_2 = V_2P_2\ T_1$
    - **Temperature must be in Kelvins!**

$T_1 = \frac{P_1V_1T_2}{P_2\,V_2}$ $P_1 = \frac{P_2V_2T_1}{T_2\,V_1}$ $V_1 = \frac{P_2V_2T_1}{P_1T_2}$

$T_2 = \frac{P_2V_2T_1}{P_1V_1}$ $P_2 = \frac{P_1V_1T_2}{T_1V_2}$ $V_2 = \frac{P_1V_1T_2}{P_2T_1}$

- **Ideal Gas Law**
  - $PV = nRT$
    - P = pressure (atm, torr, kPa)
    - V = volume (can be in mL, L, cm^3)
    - n = amount of gas/# of particles (moles)
    - T = temperature (**must be in Kelvins!**)
    - R = CONSTANT (won't affect significant digits)
      - Look at units for pressure to choose correct R
        - If P is in atm: R = 0.08207
        - If P is in torr: R = 62.36
        - If P is in kPa: R = 8.315

$P = \frac{nRT}{V}$ $n = \frac{PV}{RT}$

$V = \frac{nRT}{P}$ $T = \frac{PV}{nR}$

$R = \frac{PV}{nT}$

Remember STP:
Temperature = 273 K (0°C)
Pressure = 101.3 kPa (1 atm)

Remember Temp Conversions:
K = °C + 273

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- **Dalton's Law of Partial Pressure**
  - Formula: $P_{TOTAL} = P_1 + P_2 + P_3 + \ldots$
- **Graham's Law of Effusion**

$$\frac{Rate\ of\ A}{Rate\ of\ B} = \sqrt{\frac{molar\ mass\ of\ B}{molar\ mass\ of\ A}}$$

Chapter 15 and 16 Reference Sheet

- **Percent by Mass of Water**
  - $\frac{\text{Mass of water}}{\text{Mass of hydrate}} \times 100\ \%$
- **Henry's Law**
  - $\frac{S_1}{P_1} = \frac{S_2}{P_2}$
    - S_1 = solubility at 1st pressure (g/L)
    - P_1 = 1st pressure (can be in mm of Hg, atm, kPa)
    - S_2 = solubility at 2nd pressure (g/L)
    - P_2 = 2nd pressure(can be in mm of Hg, atm, kPa)

$S_1 = \frac{S_2P_1}{P_2}$ $P_1 = \frac{S_1P_2}{S_2}$

$S_2 = \frac{S_1P_2}{P_1}$ $P_2 = \frac{S_2P_1}{S_1}$

- **Molarity (*M*)**
  - $M = \frac{\text{moles of solute}}{\text{Liters of solution}}$
  - moles of solutes = (Molarity) (Liters of solution)
  - $\text{Liters of solution} = \frac{\text{moles of solute}}{\text{Molarity}}$
- **Moles of Solute**
  - $M_1 V_1 = M_2 V_2$
    - M_1 = 1st Molarity (*M*)
    - V_1 = 1st Volume (can be in mL, L, cm^3)
    - M_2 = 2nd Molarity (*M*)
    - V_2 = 2nd Volume (can be in mL, L, cm^3)

$V_1 = \frac{V_2M_2}{M_1}$ $M_1 = \frac{V_2M_2}{V_1}$

$V_2 = \frac{V_1M_1}{M_2}$ $M_2 = \frac{V_1M_1}{V_2}$

- **Calculating percent by volume (v/v)**
  - $\text{Percent by volume} = \frac{\text{volume of solute}}{\text{volume of solution}} \times 100\%$
- **Calculating percent by mass (m/m)**
  - $\text{Percent by mass} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 100\%$

Converting between Pressures

__ atm x $\frac{760\text{ mm Hg}}{1\text{ atm}}$	__ mm Hg x $\frac{1\text{ atm}}{760\text{ mm Hg}}$	__ kPa x $\frac{1\text{ atm}}{101.3\text{ kPa}}$
__ atm x $\frac{101.3\text{ kPa}}{1\text{ atm}}$	__ mm Hg x $\frac{101.3\text{ kPa}}{760\text{ mm Hg}}$	__ kPa x $\frac{760\text{ mm Hg}}{101.3\text{ kPa}}$