CONCEPT: MAXWELL-BOLTZMANN DISTRIBUTION

- The **Maxwell-Boltzmann Distribution** is a *probability distribution* that describes the speed of ideal gases at a given *T*.
  - □ **Probability Distribution:** The region of the curve that shows the relative number of gas molecules.
    - A distribution function is used to determine its varying velocities, but that is beyond our scope.

Distribution Function (HARD)

$$\rho(v) = 4\pi\left(\frac{m}{2\pi kT}\right)^{3/2} v^2 e^{-\frac{mv^2}{2kT}}$$

Memory Tool

Just remember: **2**, **8**, **3** for your velocity.

Maxwell-Boltzmann Distribution

_____ Speed

□ The speed at the top of the curve that represents the largest number of molecules with that speed.

$$v_p = \sqrt{\frac{RT}{M}}$$

_____ Speed

□ The average speed of gaseous molecules.

$$\bar{v} = \sqrt{\frac{RT}{M}}$$

_____ Speed

□ The speed that is the square root of the average speed-squared.

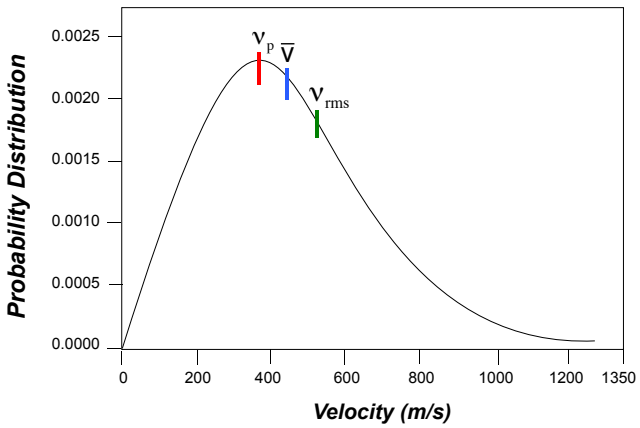
$$v_{rms} = \sqrt{\frac{RT}{M}}$$

□ M = Molar mass of the gas in $\frac{kg}{mol}$.

□ R = Gas constant of the gas in $8.314\ \frac{J}{mol \cdot K}$.

□ T = Temperature of the gas in Kelvin.

Distribution Curve



□ The varying velocities for a collection of gas molecules.

□ In terms of ⇧ velocity: _____ > _____ > _____

EXAMPLE: Calculate the most probable speed of F_2 molecules at 335 K.

PRACTICE: Calculate the molar mass of an unknown gas if its average speed is 920 m/s at 303 K.