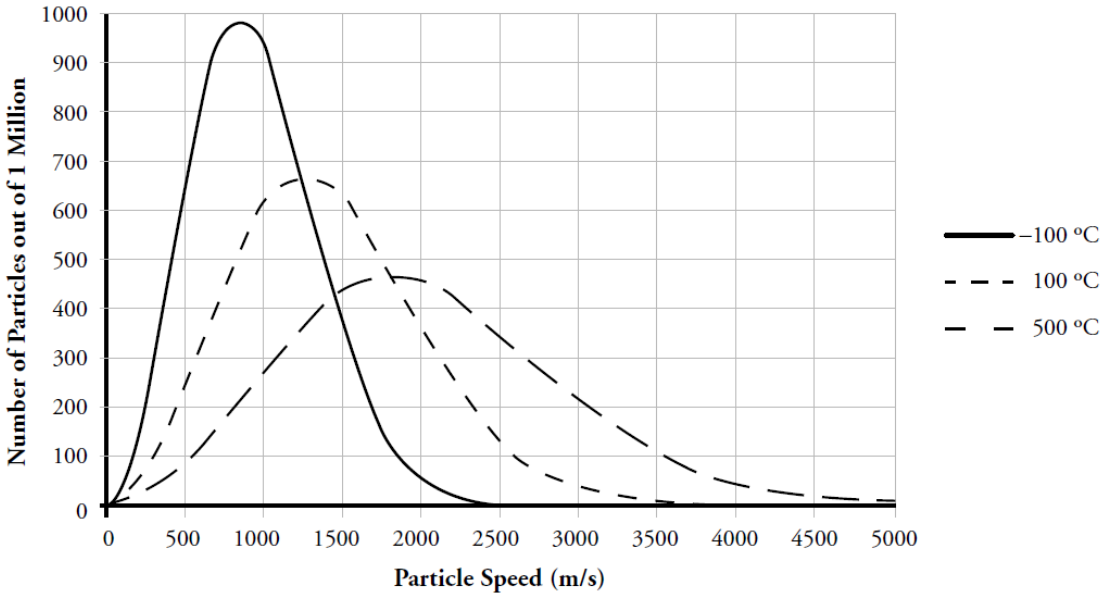
Maxwell-Boltzmann Distributions

How does temperature change the speed of gas particles?

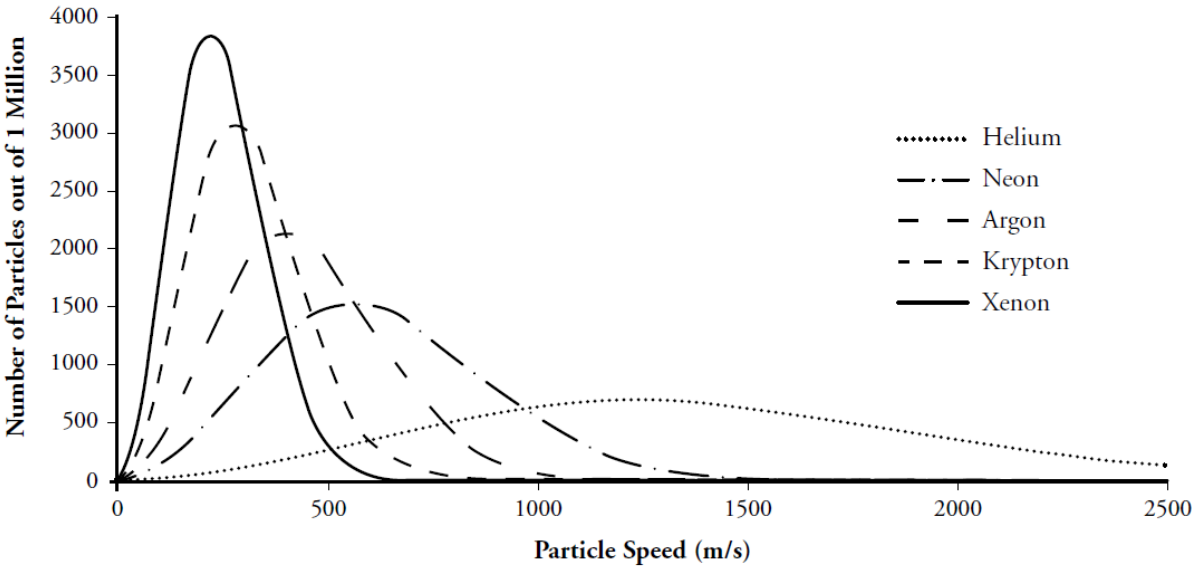
Why?

When a sample of matter is heated, the particles speed up. But what does that mean? Are all the particles in a sample moving at the same speed? Do they all speed up equally? Does mass affect particle speed? Two scientists, James Maxwell and Ludwig Boltzmann, proposed an equation that could be used to predict the speeds of ideal gas particles (atoms or molecules) at any temperature. Their equation is based on statistics and thermodynamic relationships. It is used by chemists and physicists to predict properties of gases such as pressure and diffusion rates, and it can be used to predict rates of reactions involving gases.

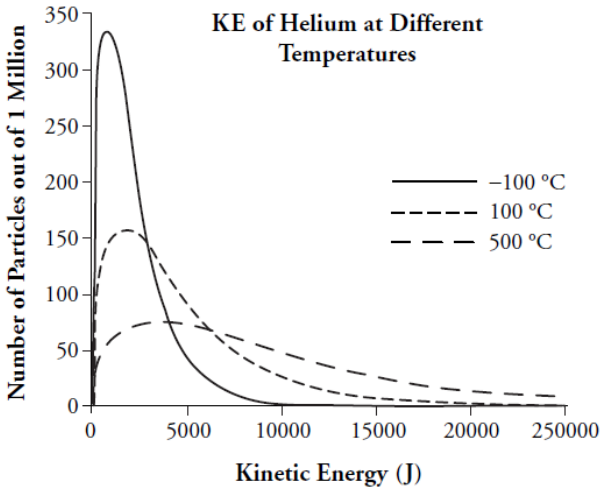
Model 1 – Helium at Different Temperatures

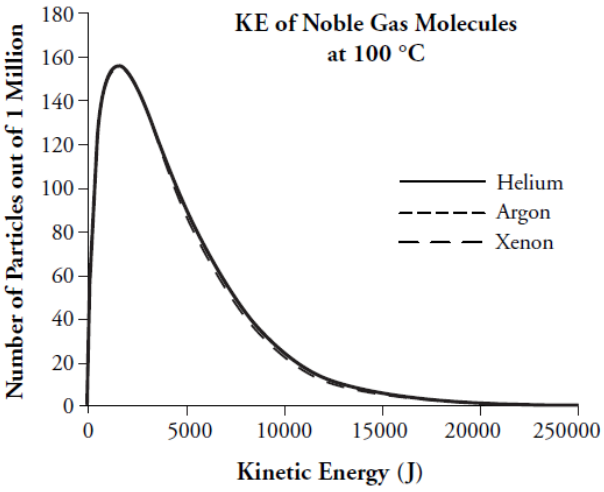


Model 2 – Noble Gases at 100 °C



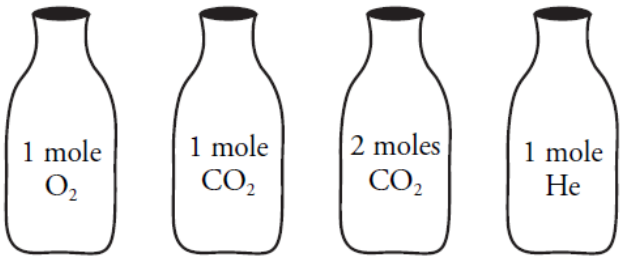
Model 3 – Kinetic Energies





$$KE = \frac{1}{2}mv^2$$

A student is presented with four bottles containing different gases. All samples are at the same temperature.



a. Which gas sample has the fastest average particle speed?

b. Which gas sample has the highest average kinetic energy?