

PhyzJob: The Kinetic Theory of Gases

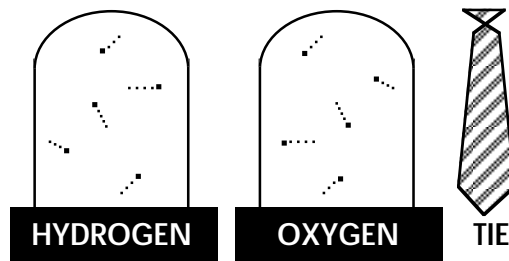


1. Consider two equal volumes of gas: one jar of hydrogen (H_2) and one jar of oxygen (O_2).

a. If the gases have the same temperature, which molecules have a greater average kinetic energy?

H_2 O_2 H_2 and O_2 molecules have equal KE's

Explain your answer:



b. If the gases have the same temperature, which molecules have a greater average speed?

H_2 O_2 H_2 and O_2 molecules have equal average speeds

Explain your answer:

c. If the H_2 and O_2 molecules had equal average speeds, which gas would be hotter?

H_2 O_2 H_2 and O_2 molecules have equal temperatures

Explain your answer:

2. The average kinetic energy of the molecules in a gas can be calculated from the absolute temperature via the following equation: $KE_{avg} = (3/2)kT$ (k is called Boltzman's constant and is $k = 1.38 \times 10^{-23} \text{J/K}$)

a. What is the average kinetic energy of a nitrogen molecule (N_2) at room temperature?

b. The *rms* ("root-mean-square") speed of the molecules can be calculated via the average kinetic energy (since KE depends on v) by this relation: $v_{rms} = \sqrt{(2KE/m)} = \sqrt{(3kT/m)}$.

The mass of a nitrogen molecule is $4.65 \times 10^{-26} \text{kg}$. What is the *rms* speed of a nitrogen molecule zipping around the room?

c. If the *rms* speed were doubled, what would the temperature of the nitrogen be?