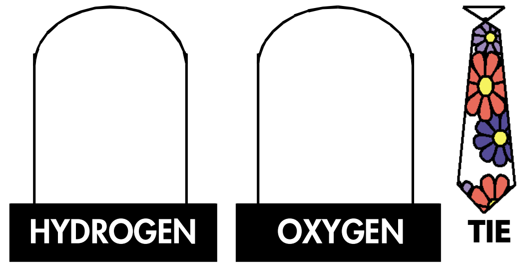
PhyzJob:
The Kinetic Theory of Gases

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 Boltzmann's constant and is $k = 1.38 \times 10^{-23}$ 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 4.65×10^{-26} 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?

2.a. 6.1E–21 J   b. 511 m/s   c. 1172 K