PAL Problem Set 22 for Phys 5A
(Ideal Gas)

Always explain your answers and show your work.

Problem 1 - What is the mass, in u, of a molecule of water, H_2O?

Problem 2 - A rigid container holds both hydrogen gas (H_2) and nitrogen gas (N_2) at 100°C. What is the ratio $(v_{rms}\ of\ H_2)/(v_{rms}\ of\ N_2)$?

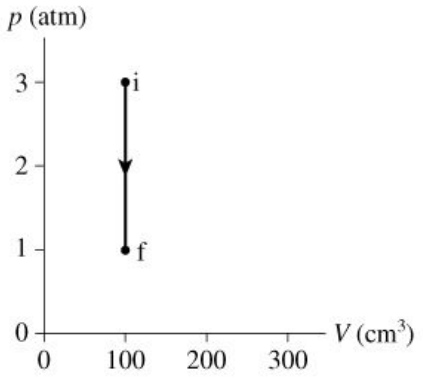
Problem 3 - Two cylinders, A and B, contain the same type of gas at the same temperature. Cylinder A has three times the volume of cylinder B and contains half as many molecules as cylinder B. What is the ratio p_B/p_A?

Problem 4 - An adult inhales about 4 L of fresh air during a breath. Assume the pressure in the lungs is 1 atm and the air is at a chilly temperature of $10\ ^oC$.

A. Only 20% of fresh air is oxygen. How many oxygen molecules are in each breath?

B. If you hold the volume of your lungs constant (a good approximation) and the number of molecules in your lungs stays constant as well (also a good approximation), what is the increase in pressure inside your lungs as you warm up the air to your body temperature of 37 °C?

Problem 5 - 0.0040 mol of H_2 undergoes the process shown in the figure.



A. What type of process is this?

B. What is the initial temperature?

C. What is the final temperature?

Imagine that next we allow the gas to expand. The gas keeps its pressure constant at 1 atm but the volume increases to 300 cm^3.

D. What type of process is this?

E. How much work does the gas do in this process?

F. What is the final temperature of the gas?

G. Is this an adiabatic process? Clearly explain.