Assignment 4

Thermodynamics II

Chapter 18: Thermal Properties of Matter

Important Formulas and Concepts:

$PV = nRT$

$(K.E)_{avg} = \frac{3}{2} kT$

$V_{rms} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3RT}{M}}$

Question 1:

(a) What is the volume of a container that holds exactly 1 mole of an ideal gas at standard temperature and pressure (STP), defined as T = 0°C = 273.15 K and p = 1atm = 1.013×10^5 Pa?
(b) When a car is driven some distance, the air pressure in the tires increases. Why? Should you let out some air to reduce the pressure? Why or why not?

Question 2:

Helium gas with a volume of 2.60 L, under a pressure of 0.180 atm, and at a temperature of

41.0°C is warmed until both pressure and volume are doubled.

(a) What is the final temperature?
(b) How many grams of helium are there? The molar mass of helium is 4.00 g/mol.

Question 3:

A flask contains a mixture of neon (Ne), krypton (Kr), and radon (Rn) gases.

(a) Compare the average kinetic energies of the three types of atoms.
(b) the root-mean-square speeds. (You will need the Molar masses of Ne and Kr).

Question 4:

You have two identical containers, one containing gas A and the other containing gas B. The masses of these molecules are $m_A = 3.34 \times 10^{-27}$kg and $m_B = 5.34 \times 10^{-26}$ kg. Both gases are under the same pressure and are at 10.0°C.

(a) Which molecules (A or B) have greater translational kinetic energy per molecule and rms speeds?
(b) If we raise the temperature of only one of these containers so that both gases will have the same rms speed. For which gas should you raise the temperature?
(c) At what temperature will you accomplish your goal?
(d) Once you have accomplished your goal, which molecules (A or B) now have greater average translational kinetic energy per molecule?