Name: _____

Block: _____

Gas Laws Review Problems

The Goodyear blimp is a dirigible with an approximate volume of $5.74 \times 10^6\,\ell$. The blimp is filled with a "heliox" mixture that contains 79% helium and 21% and oxygen (the oxygen being necessary so that people can breathe normally inside the blimp). The average molar mass of the heliox mixture is $9.88\,\frac{\text{g}}{\text{mol}}$.

1. If the normal operating pressure inside of the blimp is approximately 1.005 atm, how many tonnes of gas would be needed to inflate the blimp on a 25°C day, ? (1 tonne = 1,000 kg = 10^6 g)

2. As stated above, the mole fraction of oxygen inside the blimp, $\chi_{O_2} = 0.21$. If the total gas pressure inside the blimp is 1.005 atm, what is the partial pressure of helium inside the blimp?

3. An open manometer is filled with mercury and connected to the Goodyear blimp. (*I.e.,* the "gas" side of the manometer is measuring the pressure inside the blimp, and the other end of the manometer is open to the air outside the blimp.) If the pressure inside the blimp is 1.005 atm, and the atmospheric pressure outside the blimp is 0.985 atm, what is the difference in the height of the mercury between the two arms of the manometer?

4. On a 25°C day, the Goodyear blimp is inflated with its helium/oxygen mixture to its normal volume. During the flight, the temperature drops to 15°C. Assuming that the pressure inside the blimp remains constant at 1.005 atm, what is the volume of the blimp during the flight? Which gas law did you use for this calculation?

5. A small leak develops in the Goodyear blimp, and 100. ℓ of gas escapes. If the average velocity of the air molecules outside the blimp is 500. $\frac{\mathrm{m}}{\mathrm{s}}$, what is the average velocity of the helium molecules escaping from the blimp? (The average molar mass of air is 28.8 $\frac{\mathrm{g}}{\mathrm{mol}}$.)