Matter and Motion Fall 2015

Chemistry Workshop 6

The workshop is intended to be a low-pressure setting where we get to practice problems, ask any questions, and discuss concepts and problem solving methods. Have fun! Work together on whiteboards or scratch paper and then neatly write your solutions in the notebook where you keep chemistry class notes. Your workshop solutions will be included in your portfolio.

Useful Information: PV=nRT R=0.0820575 L·atm/(mol·K) = 62.3637 L·torr/(mol·K); 1 atm = 760 torr = 101325 Pa

1. A sample of gas occupies 353 mL at 92.5°C and 735 torr pressure. a) How many moles of gas are present? b) What volume will the sample occupy at 25.0°C and 1600.0 torr?

2. If you put a drinking straw in water, place your finger over the opening, and lift the straw out of the water, then some water stays in the straw. Explain. Do you think there is a limit to how tall or wide a straw can be for this to work? Why?

3. A tank containing 500.0 g of argon has a gas pressure of 175.0 atm at 50.0°C. If the tank and gas are cooled to -50.0°C, what is the gas pressure in the tank?

4. If a mix of 20.00 g of chlorine and 20.00 g of argon exert a total pressure of 1100.0 torr, what is the partial pressure of each gas?

5. Consider three identical flasks filled with different gases.
Flask A: CO at 760 torr and 10°C
Flask B: N_2 at 350 torr and 10°C
Flask C: H_2 at 200 torr and 10°C
a) In which flask will the molecules have the greatest kinetic energy?
b) In which flask will the molecules have the greatest average velocity?

6. Real gases often deviate from ideal gas behavior. The van der Waals equation represents a more accurate way of accounting for real gases: $\left[P_{obs} + a\left(\frac{n}{V}\right)^2\right] \times (V - nb) = nRT$, where a and b, the van der Waals constants, represent the attraction between molecules and the volume of molecules, respectively. Show that the van der Waals equation simplifies to the ideal gas law at the low-pressure and high-temperature limit.

7. A sample of an ideal gas at 15.0 atm and 10.0 L is allowed to expand against a constant pressure of 2.00 atm at a constant temperature. Calculate the work in units of kJ for the gas expansion.