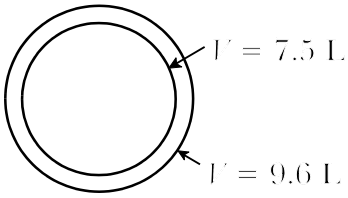
CHEM441-001/002 Name _____
College of Charleston
Fall 2000
Exam I Score _____ /100

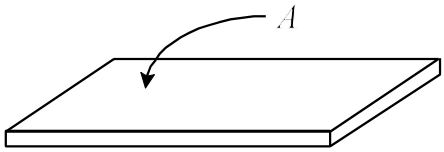
1(10). Real gases approach ideal gas behavior under conditions of _____ temperature and _____ pressure. Positive deviations of $Z = PV_m/RT$ from ideality by a real gas are usually attributed to _____ and negative deviations are usually attributed to _____ .

2(20). Given the molar volume of a real gas is 18.7 L at 26.3 °C and 1.26 bar. Calculate the compressibility factor for the gas under these conditions and the approximate value of the second virial coefficient B_p at this temperature.

3(20). A sample of He is placed in a 7.5 L container at a pressure of 5.2 bar. The sealed He container is then placed in a larger container (V = 9.6 L) and the space between the containers is filled with Ne to a pressure of 2.0 bar. After the seal on the He container is broken, what is the total pressure of the gaseous mixture and the mole fraction of He in the mixture?



4(20). Consider one mole of an ideal gas in a container that is one molecule thick.



Experimentally it is observed that the pressure P that the gas exerts is inversely proportional to the surface area A of the container under isothermal conditions. Express this relationship mathematically and evaluate $(\partial P/\partial A)_T$.

Experimentally it is observed that the pressure P that the gas exerts is directly proportional to the temperature T under conditions of constant area. Express this relationship mathematically and evaluate $(\partial P/\partial T)_A$.

Assuming $P = P(A,T)$, write the total differential dP, substitute your results from above, and derive the "ideal gas law" for this system.

5(20). A sample of atmospheric oxygen taken from the upper atmosphere has a density of 0.0150 g L^{-1} at 0.162 bar and 2345 K.
Calculate the average molar mass of the sample.

Assuming the sample contains only molecular and atomic oxygen, calculate the mole fraction of molecular oxygen present.

6(10). The screen shot shows the P-V plot for benzene. The critical isotherm at 562 K is shown. Show clearly on the diagram an isotherm for 700 K and an isotherm for 200 K.