# Problems of the Week 2

**Always <u>show your all</u> work to receive credit (NO WORK=NO CREDIT)**

1. A tube of negligible volume connects two evacuated bulbs of equal volume. One bulb is placed in a 200K constant temperature bath and the other in a 300K bath, and 1.00g of an ideal gas is injected into the system. Calculate the final number of grams of the ideal gas in the bulb that is in the 200K bath (**1 point**).
   A. 0.33g B. 0.40g C. 0.60g D. Q=0.67g E. 0.80g

2. The coefficient of volume expansion (i.e. the fractional change in volume per unit temperature change) of an ideal gas is equal is $\beta = \frac{1}{T}$ , where T is the temperature of the gas in Kelvin is easily derived from the expression for the coefficient of volume expression $\beta = \frac{1}{V}\left(\frac{dV}{dT}\right)_P = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)$.
   If the ratio of the number of moles to volume of gas, n/V is sufficiently high, the interaction between molecules of the gas has a measurable effect on the properties of the gas. A better model of the gas is the van der Waals model $\left(p + a\frac{n^2}{V^2}\right)(V - nb) = nRT$ where **a** and **b** are empirical constants for different gases. Constant b is a correction for the finite size of the molecule. Its value is the volume of one mole of the gas. The term $a/V^2$ arises from the intermolecular force within the gas. For example the constants **a** and **b** for $O_2$ are 0.138J-$m^3/mol^2$ and $31.8x10^{-6}m^3/mol$, respectively. Use the van der Waals model to calculate $\beta$, for 2.0moles of $O_2$ in a 1.00L container at 300K (**2 points**).
   A. $1.50x10^{-3}/K$
   B. $3.87x10^{-3}/K$
   C. $5.37x10^{-3}/K$
   D. $45.6x10^{-3}/K$
   E. $124.5x10^{-3}/K$