Quiz #10A

Clearly indicate (with a box) your answers to the following questions. SHOW ALL WORK.

1. The density of an ideal gas is 0.366 kg/m3 at a temperature of 20.0° C and a pressure of 1.00 atmospheres. If the temperature is reduced to -215°C while the pressure is increased to 13.5 atmospheres, keeping the amount of gas constant, what is the new density of the gas?

Assume $V_1 = 1\ m^3$ $\quad m = 0.366\ kg$

$T_1 = 293 K$ $\quad T_2 = 58 K$

$P_1 = 1\ atm$ $\quad P_2 = 13.5\ atm$

$N_1 = N_2$

$$V = \frac{nRT}{P}$$

$$\frac{V_1}{V_2} = \frac{\left(\frac{n_1}{n_2}\right)\left(\frac{R}{R}\right)\left(\frac{T_1}{T_2}\right)}{\left(P_1/P_2\right)} = \frac{(1)(1)\left(\frac{293}{58}\right)}{\left(1/13.5\right)} = 68.2$$

$$V_2 = \frac{1}{68.2} = .0147\ m^3$$

$$\rho_2 = \frac{0.366}{.0147} = \boxed{25.0\ kg/m^3}$$

2. 35 grams of ice (specific heat = 2090 J/kg-C) at -81° C is put into a 74 gram container (specific heat = 765 J/kg-C) filled with 64 grams of water (specific heat = 4186 J/kg-C). Both the container and water are at an initial temperature of 33° C. The latest heat of fusion for water is 333,000 J/kg.

If the final temperature of the system is zero, calculate how much of the ice melts.

If the final temperature of the system is not zero, simply find the final temperature of the system.

Assume ice melts:

$\Delta Q_{ice} + \Delta Q_c + \Delta Q_w = 0$

$(.035)(2090)(81) + (.035)(333{,}000) + (.035)(4186)(T_F - 0)$

$+ (.074)(765)(T_F - 33) + (.064)(4186)(T_F - 33) = 0$

$5925 + 11655 + 146.5T_F + 56.6T_F - 1868$

$+ 268T_F - 8841 = 0$

$6871 + 471T_F = 0 \qquad T_F = \cancel{-15°C}$

Not all ice melts:

$(.035)(2090)(81) + m(333{,}000) + 56.6T_F - 1868 + 268T_F - 8841 = 0$ (with $T_F = 0$)

$5925 + 333{,}000m - 1868 - 8841 = 0$

$333{,}000m = 4784$

$m = .014 =$ **14 grams melts**