

## Phys 10154 - Fall 2006 - Exam #10B

Be sure to answer with the proper units and significant figures. Indicate your answers clearly with boxes. **SHOW ALL WORK.** Even if your answer is correct, I will deduct points if I can't see how you solved the problem. Both problems are worth 50 points.

#1. The density of a gas at 85° C and 2.0 atm is 0.42 kg/m<sup>3</sup>. If this same amount of gas is changed to a new pressure and temperature of 25° C and 1.0 atm, what is the new density of the gas?

$$\begin{array}{ll} T_1 = 358 \text{ K} & T_2 = 298 \text{ K} \\ P_1 = 2.0 \text{ atm} & P_2 = 1.0 \text{ atm} \\ V_1 = 1.0 \text{ m}^3 & V_2 = ? \end{array}$$

$$\frac{V_1}{V_2} = \frac{\left(\frac{n_1}{n_2}\right)\left(\frac{R}{R}\right)\left(\frac{T_1}{T_2}\right)}{\left(\frac{P_1}{P_2}\right)} = (1)(1)\left(\frac{358}{298}\right)\left(\frac{1.0}{2.0}\right)$$
$$= 0.60$$

$$V_2 = \frac{V_1}{.60} = 1.66 \text{ m}^3$$

$$\rho_2 = \frac{0.42}{1.66} = \boxed{0.25 \text{ kg/m}^3}$$

#2. 95 grams of steam at a temperature of 130° C is added to an aluminum pot of water at 22° C. The pot is 140 grams, and the amount of water in the pot is 220 grams.

Determine the final temperature of the system. If the final temperature is 100° C, calculate the amount of steam that condenses into water.

$\Delta Q$  to cool steam to 100°C:

$$(.095)(2010)(-30) = -5728.5$$

$\Delta Q$  to condense steam:

$$-(.095)(2.26 \times 10^6) = -214700$$

$\Delta Q$  to heat pot:

$$(.140)(900)(78) = 9828$$

$\Delta Q$  to heat water:

$$(.220)(4186)(78) = 71831.76$$

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not all steam condenses

$$\Delta Q_s + \Delta Q_{pot} + \Delta Q_{water} = 0$$

$$-5728.5 - m(2.26 \times 10^6) + 9828 + 71831.76 = 0$$

$$m(2.26 \times 10^6) = 75931.26$$

$$m = .0336$$

34 g of steam condenses