

Phys 10154 - Fall 2006 - Exam #10A

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 25° C and 1.0 atm is 0.12 kg/m³. If this same amount of gas is changed to a new pressure and temperature of 125° C and 2.5 atm, what is the new density of the gas?

$$T_1 = 298K \quad T_2 = 398K$$

$$P_1 = 1.0 \text{ atm} \quad P_2 = 2.5 \text{ atm}$$

$$V_1 = 1.0 \text{ m}^3 \quad V_2 = ?$$

$$\frac{V_1}{V_2} = \frac{\frac{n_1 R T_1}{P_1}}{\frac{n_2 R T_2}{P_2}} = (1)(1) \left(\frac{298}{398} \right) \left(\frac{2.5}{1.0} \right)$$

$$V_2 = \frac{V_1}{1.87} = 0.534$$

$$\rho_2 = \frac{0.12}{0.534} = \boxed{0.22 \text{ kg/m}^3}$$

75

#2. ~~380~~ grams of ice at a temperature of -47°C is added to an aluminum pot of water at 22°C . The pot is 120 grams, and the amount of water in the pot is 240 grams.

Determine the final temperature of the system. If the final temperature is zero, calculate the amount of ice that melts.

$$\begin{aligned}\Delta Q \text{ to melt ice: } & (.075)(3.33 \times 10^5) = 24975 \\ & + (.075)(2090)(47) \quad + 7367.25 \\ & = \underline{32342.25 \text{ J}}\end{aligned}$$

ΔQ to cool Al + water to 0°C

$$(.120)(900)(-22) + (.240)(4186)(-22) = \underline{-24478.1 \text{ J}}$$

Not all ice melts

$$\underline{\Delta Q_{\text{Al}} + \Delta Q_{\text{w}} + \Delta Q_{\text{ice}} = 0}$$

$$-24478.1 + 7367.25 + m(333000) = 0$$

$$m(333000) = 17110.85$$

$$m = .051$$

51g of ice melts