PHYS 262 Homework 8 (Ch21) Spring '03

1. (SB 5) Using the result of Problem 1 in HW7

$$P = Nm\frac{2v\sin\theta}{At}$$

$$= 17.6 \text{ kPa} \#$$

2. (SB 14) $Q = nC_p\Delta T$

$$\Delta T = \frac{Q}{nC_p} \quad (C_p = C_v + R = \tfrac{7}{2}R)$$

∵ pressure is constant, $\frac{V_i}{T_i} = \frac{V_f}{T_f}$

$$V_f = \left(\frac{T_f}{T_i}\right)V_i = \left(1 + \frac{\Delta T}{T_i}\right)V_i$$

$$= \left(1 + \frac{2Q}{7nRT_i}\right)V_i$$

$$= 7.52 \text{ L} \#$$

3. (SB 15) (a) $Q = nC_p\Delta T$

$$= (28.8 \text{ J/mol·K})(420\text{K} - 300\text{K}) \quad \text{(use values of } C_p \text{ from Table 21.2)}$$

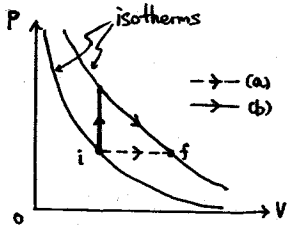
$$= 3460 \text{ J} \#$$

(b) $\Delta E_{int} = nC_v\Delta T = 2.45 \text{ kJ} \#$ $(C_v = 20.4 \text{ J/mol·K})$

(c) $\Delta E_{int} = Q - W$

$$W = Q - \Delta E_{int}$$

$$= 1.01 \text{ kJ} \#$$



4. (SB 24) (a) $P_iV_i^{\gamma} = P_fV_f^{\gamma}$

$$\frac{V_f}{V_i} = \left(\frac{P_i}{P_f}\right)^{\frac{1}{\gamma}} = \left(\frac{1}{20}\right)^{\frac{5}{7}} = 0.118 \#$$

(b) $\frac{P_iV_i}{T_i} = \frac{P_fV_f}{T_f}$

$$\frac{T_f}{T_i} = \left(\frac{P_f}{P_i}\right)\left(\frac{V_f}{V_i}\right) = 2.35 \#$$

(c) ∵ adiabatic, $Q = 0$ J #

$$\Delta E_{int} = nC_v\Delta T$$

$$= (0.016)\left(\tfrac{5}{2}R\right)(2.35T_i - T_i) \quad (\gamma = 1.4 \Rightarrow \frac{C_v+R}{C_v} = 1.4)$$

$$= 135 \text{ J} \# \quad (T_i = 300 \text{ K})$$

$$W = Q - \Delta E_{int}$$

$$= -135 \text{ J} \#$$

5. (SB 44) (a) 2430 J is needed to evaporate 1 g of water

$$\therefore \text{KE of 1 molecule} = \frac{2430\text{J}}{\text{no. of molecules in 1 g}}$$

$$= \frac{2430\text{J}}{N_A/18\text{g}}$$

$$= 7.27 \times 10^{-20} \text{ J} \#$$

(b) $\overline{KE} = \frac{1}{2}mv_{rms}^2 \Rightarrow v_{rms} = 2.21 \text{ kms}^{-1} \#$ $(\text{note: } m = \frac{18\text{g}}{N_A})$

(c) $\overline{KE} = \frac{1}{2}mv_{rms}^2 = \frac{3}{2}k_BT \Rightarrow T = 3510 \text{ K} \#$