

Homework #3

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1.38) A: adiabatic

B: isothermal

$$P_{A0} = P_{B0} = P_0 ; P_{Af} = P_{Bf} = P_f ; V_{A0} = V_{B0} = V_0$$

$$V_0^\gamma P_0 = V_{Af}^\gamma P_f$$

$$\left(\frac{V_0}{V_A}\right)^\gamma = \frac{P_f}{P_0}$$

$$\frac{V_0}{V_A} = \left(\frac{P_f}{P_0}\right)^{1/\gamma}$$

$$V_A = \left(\frac{P_0}{P_f}\right)^{1/\gamma} V_0$$

$$V_B P_f = P_0 V_0$$

$$V_B = \frac{P_0}{P_f} V_0$$

$$1/\gamma < 1$$

$$\frac{P_0}{P_f} > 1$$

$$\therefore \frac{P_0}{P_f} > \left(\frac{P_0}{P_f}\right)^{1/\gamma}$$

$$\therefore V_B > V_A$$

1.42) $Q = m C \Delta T$

$$\rho_w = 1 \text{ kg/L}$$

$$m_w = 1500 \text{ g}$$

$$C_w = 4.186 \text{ J/g}^\circ\text{C}$$

$$340 \text{ g} \cdot 1.8 \text{ J/g}^\circ\text{K} \cdot (T_f - 298.15 \text{ K}) = -1500 \text{ g} \cdot 4.186 \text{ J/g}^\circ\text{K} \cdot (T_f - 373.15 \text{ K})$$

$$612 \text{ J/K} T_f - (612 \cdot 298.15) = -6279 \text{ J/K} + 2.343 \text{ MJ}$$

$$6891 \text{ J/K} T_f = 2.525 \times 10^6 \text{ J}$$

$$T_f = 366.5 \text{ K} = 93.34^\circ\text{C}$$

The water temperature is decreased by 6.66°C

1.50) $\text{C}_2\text{H}_4(\text{gas}) + 2\text{O}_2(\text{gas}) \rightarrow \text{CO}_2(\text{gas}) + 2\text{H}_2\text{O}(\text{gas})$

$$\Delta_f H: -74.81 \text{ kJ}$$

$$0 \text{ J}$$

$$-393.51 \text{ kJ}$$

$$-241.82 \text{ kJ}$$

(a) $\Delta_f H_{\text{H}_2\text{O}} = 0 \text{ J}$

$$\Delta_f H_{\text{graphite}} = 0 \text{ J}$$

$$\Delta_f H_{\text{C}_2\text{H}_4} = -74.81 \text{ kJ}$$

$$(b) \Delta H = -793.51 \text{ kJ} - 241.82 \text{ kJ} + 74.81 \text{ kJ} \\ = -560.52 \text{ kJ}$$

2.1) (a)

H	H	H	H
H	H	H	T
H	H	T	H
H	H	T	T
H	T	H	H
H	T	H	T
H	T	T	H
H	T	T	T
T	H	H	H
T	H	H	T
T	H	T	H
T	H	T	T
T	T	H	H
T	T	H	T
T	T	T	H
T	T	T	T

$$(b) \begin{aligned} 4H &: 1/16 \\ 3H &: 1/4 \\ 2H &: 2/8 \\ 1H &: 1/4 \\ 0H &: 1/16 \end{aligned}$$

$$(c) \begin{aligned} \Omega(4H) &= \frac{4!}{4!0!} = 1 \\ \Omega(3H) &= \frac{4!}{3!1!} = 4 \\ \Omega(2H) &= \frac{4!}{2!2!} = \frac{24}{4} = 6 \\ \Omega(1H) &= \frac{4!}{1!3!} = 4 \\ \Omega(0H) &= \frac{4!}{0!4!} = 1 \end{aligned}$$