

Homework Solutions
10/23/2007

54. a.

$$W_{ongas} = -P\Delta V$$

$$W_{ongas} = -(3P_0 - P_0)(3V_0 - V_0) = -4P_0V_0$$

$$W_{bygas} = -W_{ongas} = -(-4P_0V_0) = 4P_0V_0$$

b.

$$\Delta U = 0$$

$$Q = -W = -(-4P_0V_0) = 4P_0V_0$$

c.

$$PV = nRT$$

$$P_0V_0 = nRT_0$$

$$W_{bygas} = 4P_0V_0$$

$$W_{bygas} = 4nRT_0 = 4(1mole) \left(8.31 \frac{J}{moleK} \right) (273K) = 9.07 \cdot 10^3 J$$

57. a.

$$Q_{Al} = m_{Al} L_f$$

$$Q_{Al} = (0.001kg) \left(3.97 \cdot 10^5 \frac{J}{kg} \right) = 397J$$

$$Q_{Hg} = m_{Hg} L_f$$

$$Q_{Hg} = (0.015kg) \left(1.18 \cdot 10^4 \frac{J}{kg} \right) = 177J$$

$$e = 1 - \frac{Q_c}{Q_H} = 1 - \frac{177J}{397J} = 0.554 = 55.4\%$$

b.

$$e_c = 1 - \frac{T_c}{T_H} = 1 - \frac{234K}{933K} = 0.749 = 74.9\%$$