CHEM441-001/002
College of Charleston
Fall 1999
Exam IV

1(25). The calorimeter constant for a solution calorimeter was determined by pouring 50.0 g of hot water at 97.3 ºC into 100.0 g of cool water in the calorimeter at 23.7 ºC resulting in a final temperature of 41.8 ºC. Calculate the calorimeter constant given C_p = 4.184 J K^{-1} g^{-1} for water.

Exactly one mole of a hot metal at 86.2 ºC was poured into 100.0 g of cool water in the calorimeter at 22.3 ºC resulting in a final temperature of 24.7 ºC. Determine the molar heat capacity of the metal.

Compare this experimental molar heat capacity of the metal to that predicted by the Law of Dulong-Petit.

2(45). A student was interested in which of two processes involving one mole of an ideal monatomic gas would generate the greater amount of work:

1) reversible isothermal expansion from P_1 = 100.00 bar to P_2 = 10.00 bar at 298 K followed by a reversible adiabatic expansion to P_3 = 1.00 bar.
2) reversible adiabatic expansion from P_1 = 100.00 bar to P_2 = 10.00 bar followed by a reversible isothermal expansion to P_3 = 1.00 bar.

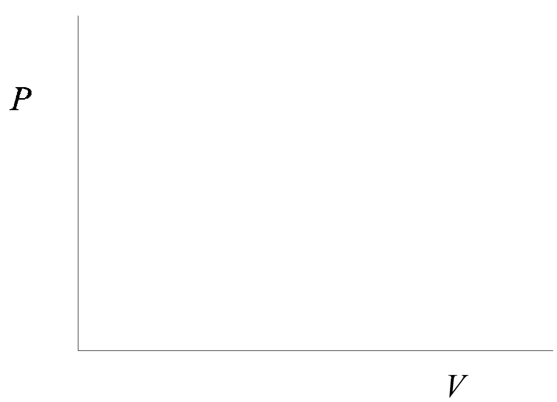
A) Calculate the total work for the first process.

B) Calculate the total work for the second process.

C) Which process yields the greater amount of work and by how much?

D) On the *P*-*V* axes given, indicate the two processes and show graphically the *difference* in the work.

E) Calculate the overall values of *q*, Δ*U*, and Δ*H* for the first process.



F) Calculate the overall values of q, ΔU, and ΔH for the second process.

G) Compare the overall values of ΔU and ΔH for the two processes.

3(30). Consider the following reaction

$$O_3(g) \rightarrow O_2(g) + O(g)$$

A) Given $\Delta_f H^o_{298}$/(kJ mol^{-1}) = 142.7 for O_3 and 249.170 for O, calculate $\Delta_r H^o_{298}$.

B) Given $(H^o_T - H^o_0)$/(kJ mol^{-1}) = 6.724 for O, 8.680 for O_2, and 10.350 for O_3, calculate $\Delta_r H^o_0$.

C) Given the bond enthalpy = 493.59 kJ mol^{-1} for O_2 at 0 K, calculate the average bond enthalpy for the oxygen-oxygen bonding in O_3.