

Problem Set 2A**Problems: Z9.28 (4th Ed) or Z9.30 (5th Ed), Q2.5, P2.11, P2.12**

Work the problems to a single significant figure. Problem set is due Friday (01/18/08).

Z9.28) Consider a sample containing 2 moles of a monatomic ideal gas (I.G.) that undergoes the following changes:

$$\begin{array}{ccccccc} P_A = 10\text{atm} & \xrightarrow{1} & P_B = 10\text{atm} & \xrightarrow{2} & P_C = 20\text{atm} & \xrightarrow{3} & P_D = 20\text{atm} \\ V_A = 10\text{L} & & V_B = 5\text{L} & & V_C = 5\text{L} & & V_D = 25\text{L} \end{array}$$

For each step, assume that the external pressure is constant and equals the final pressure of the gas for that step. Compute q , w , ΔE , and ΔH for each step and for the overall change from state A to state D.

[Hint: Analyze each step, and determine the physical change that needs to happen; isothermal?, etc. and the type of change, system doing work?, etc.]

Q2.5) Two ideal gas systems undergo reversible expansion starting from the same P and V . At the end of the expansion, the two systems have the same volume. The pressure in the system that has undergone adiabatic expansion is lower than in the system that has undergone isothermal expansion. Explain this result without using equations.

P2.11) 3.50 moles of an ideal gas is expanded from 450 K and an initial pressure of 5.00 bar to a final pressure of 1.00 bar, and $C_{P,m} = 5/2R$. Calculate w for the following two cases.

- The expansion is isothermal and reversible.
- The expansion is adiabatic and reversible.

Without resorting to equations, explain why the result to part (b) is greater than or less than the result to part (a).

P2.12) An ideal gas described by $T_i = 300\text{ K}$, $P_i = 1.00\text{ bar}$, and $V_i = 10.0\text{ L}$ is heated at constant volume until $P = 10.0\text{ bar}$. It then undergoes a reversible isothermal expansion until $P = 1.00\text{ bar}$. It is then restored to its original state by the extraction of heat at constant pressure. Depict this closed-cycle process in a P - V diagram. Calculate w for each step and for the total process. What values for w would you calculate if the cycle were traversed in the opposite direction?