Chemistry 1045
Problem Set 3 Answers

1. $P_1V_1/T_1 = P_2V_2/T_2$ $\quad \frac{1.50\text{atm} \times 30.22\text{L}}{298\text{K}} = \frac{0.500\text{atm} \times V_2}{298\text{K}}$

   $V_2 = 90.7\text{L}$

2. $P_1V_1/T_1 = P_2V_2/T_2$ $\quad \frac{760\text{T} \times 2.00\text{L}}{298\text{K}} = \frac{401\text{T} \times V_2}{263\text{K}}$

   $V_2 = 3.35\text{L}$

3. $PV = nRT$ $\quad P = \frac{1.50\text{mol} \times 0.08206\ (\text{Latm/molK}) \times 300\text{K}}{3.00\text{L}}$

   $P = 12\text{atm}$

4. $P_T = P_{N_2} + P_{O_2} + P_{NO}$

   From PV=nRT $\quad P = n \times 22.4$ atm/mol

   $P_{N_2} = 0.050\text{mol} \times 22.4\ \text{atm/mol} = 1.12\text{atm}$

   $P_{O_2} = 0.15\text{g}\ (1\text{mol} / 32\text{g}) \times 22.4\ \text{atm/mol} = 0.105\text{atm}$

   $P_{NO} = 5.0 \times 10^{21}\text{molecules}\ (1\text{mol} / 6.02 \times 10^{23}\text{molecules}) \times 22.4\ \text{atm/mol} = 0.19\text{atm}$

   $P_T = 1.1\text{atm} + 0.10\text{atm} + 0.19\text{atm} = 1.4\text{atm}$

5. For an ideal gas, V at STP = 22.4 L/mol

   $V = 4.50\text{mol} \times 22.4\ \text{L/mol} = 101\text{L}$

6. $275\text{gS}\ (1\text{mol S} / 32.1\text{g S})(296\text{kJ} / 1\text{mol S}) = 2540\text{kJ}$ heat released (exothermic)

7. $\mu = (3RT/M)^{1/2}$

hydrogen gas $\mu = ((3 \times 8.31\ kgm^2/sec^2molK \times 310K) / 0.00202\ kg/mol)^{1/2}$

$\mu =$ 1960 m/sec for hydrogen

CO_2 gas $\mu = ((3 \times 8.31\ kgm^2/sec^2molK \times 310K) / 0.0440\ kg/mol)^{1/2}$

$\mu =$ 419 m/sec for carbon dioxide

8. Reverse equation 2 and multiply by 2 $\Delta H = +153.2kJ$
Multiply equation 4 by 4 $\Delta H = -696kJ$
Reverse equation 1 and multiply by 2 $\Delta H = +572kJ$

Add the ΔH's to get +29kJ
The equations add up to give $2N_2 + 5O_2 \rightarrow 2N_2O_5$

9. $\Delta H_{rxn} = \mathbf{S}\Delta H^\circ_f$ Products - $\mathbf{S}\Delta H^\circ_f$ Reactants

$\Delta H_{rxn} = (2 \times -470kJ + 0kJ) - (2 \times -286kJ + 0kJ)$

$\Delta H_{rxn} = -368kJ$