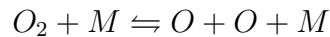


AME 60636
Examination 1
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1. Consider the three species O , O_2 and O_3 . Initially, there is 1 *kmole* of O at $T = 6000\text{ K}$ and $P = 1.01 \times 10^6\text{ dyne/cm}^2$. The system equilibrates isothermally and isobarically. The reference pressure is $P_o = 1.01 \times 10^6\text{ dyne/cm}^2$. At $T = 6000\text{ K}$, one has the following thermodynamic data:

$$\begin{aligned}\bar{h}_O &= 0.370 \times 10^{13}\text{ erg/mole}, & \bar{s}_O^\circ &= 0.224 \times 10^{10}\text{ erg/mole/K}, \\ \bar{h}_{O_2} &= 0.224 \times 10^{13}\text{ erg/mole}, & \bar{s}_{O_2}^\circ &= 0.313 \times 10^{10}\text{ erg/mole/K}, \\ \bar{h}_{O_3} &= 0.471 \times 10^{13}\text{ erg/mole}, & \bar{s}_{O_3}^\circ &= 0.401 \times 10^{10}\text{ erg/mole/K},\end{aligned}$$

- (a) Find the equilibrium concentrations of O , O_2 , and O_3 .
- (b) Imagine now that the reaction kinetics is governed by the *single reaction*



with collision frequency factor 1.85×10^{11} , temperature exponent $\beta = 0.5$, and activation energy $E = 95560.0\text{ cal/mole}$. The reaction rate has the typical units of $\text{mole/cm}^3/\text{s}$. Write the appropriate differential-algebraic system that describes the evolution of O , O_2 and O_3 .

2. Develop an expression for how *element concentration evolves* for an ideal mixture of N ideal gases undergoing J reactions in an *isobaric* environment.