AME 598t
Examination 1
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1. Consider the reaction kinetics law using the notation described in class

$$\frac{dc_i}{dt} = \sum_{j=1}^{J} \nu_{ij} \underbrace{\underbrace{\alpha_j T^{\beta_j} \exp\left(\frac{-E_j}{\Re T}\right)}_{\equiv k_j(T)} \prod_{k=1}^{N} c_k^{\nu'_{kj}} \left(1 - \frac{1}{K_{c,j}} \prod_{k=1}^{N} c_k^{\nu_{kj}}\right)}_{=r_j}.$$

   (a) Taking $K_{c,j}$, $j = 1, \ldots, J$, as having known values, give a simple sufficient condition, or set of conditions, for the i^{th} species to be in equilibrium.

   (b) Using appropriate notation as described in class, show that element mass fractions remain constant with time.

2. Species A and B have identical molecular masses and undergo an irreversible decomposition described by

$$A + A \rightarrow B + A.$$

   The reaction is isothermal and isochoric. At $t = 0$, $c_A = c_{Ao}$, and $c_B = 0$.

   (a) Write an appropriate simple ordinary differential equation for the change in concentration of species A with respect to time. Define any appropriate constants.

   (b) Find the equilbrium concentration of A.

   (c) Find $c_A(t)$.

3. Find the most general stoichiometric balance for the reaction

$$\nu'_1 H_2 + \nu'_2 O_2 \leftrightharpoons \nu''_3 H_2O + \nu''_4 OH + \nu'_5 O.$$