Problem 1. Aqueous phase oxidation of muconic acid (MA) was performed in a 1-L high pressure PARR reactor at 240°-260°C using 20-40 bar oxygen partial pressure for 3 hrs. The experimental data obtained for the MA (total organic carbon) disappearance was correlated by the following rate expression:

\[- r_{MA} = 6.439 \times 10^5 \exp(-10514/T) C_{MA}^{1.0} C_{O_2}^{0.75 \pm 0.03} \]

Calculate MA conversion as a function of time and plot it over a period of 3 hrs.

Note: Use the following empirical equation to determine the solubility of oxygen in water at higher temperatures.

\[ \ln H = a_0 + \frac{a_1}{T} + \frac{a_2}{T^2} + \frac{a_3}{T^3} + \frac{a_4}{T^4} \]

The values of the coefficients are as follows:

\[ a_0 = -35.4408 \]
\[ a_1 \times 10^4 = 5.5897 \]
\[ a_2 \times 10^7 = -2.67211 \]
\[ a_3 \times 10^9 = 5.80947 \]
\[ a_4 \times 10^{11} = -4.91667 \]

T = K
\[ C_{O_2} = \text{mol/L} \]
\[ H = \text{MPa} \]
R = gas constant, 8.314 J/mol
E = activation energy, kJ/mol