

2019 CHEM2C: Assignment 2

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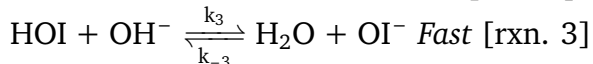
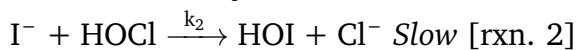
Due date: April 18 2019 (in class). Keep everything brief.

1. According to thermodynamics, the transformation from diamond to graphite is spontaneous with $\Delta G^\circ = -2.90 \text{ kJ mol}^{-1}$. However, your diamond ring hasn't turned into graphite because of the kinetics of the reaction. Estimate the rate constant and half-life (assuming first-order) of this reaction if the preexponential factor is $A = 1 \text{ s}^{-1}$ and $E_a = 540 \text{ kJ mol}^{-1}$ at $T = 298 \text{ K}$. NB: The approximate age of the sun is $1.4 \times 10^{17} \text{ s}$ and approximate age of the universe $4.3 \times 10^{17} \text{ s}$).

2. The rate constant k for the reaction $\text{H}_2 + \text{I}_2 \longrightarrow 2\text{HI}$ has been determined at two temperatures:

T (K)	k ($\text{M}^{-1} \text{s}^{-1}$)
599	5.4×10^{-4}
683	2.8×10^{-2}

- (a) Calculate the activation energy for the reaction.
 - (b) At what temperature will the rate constant for the reaction have the value $k = 5.0 \times 10^{-3} \text{ M}^{-1} \text{ s}^{-1}$?
3. Derive the rate law for the following iodide-hypochlorite reaction in aqueous solution.



4. One proposed mechanism for the formation of a double helix in DNA is given by the following reactions. Where S_1 and S_2 represent strand 1 and 2, and $(S_1-S_2)^*$ represents an unstable helix. Write the rate of reaction expression for the formation of the double helix.

