Problems:

1. Consider the reaction:
   A → B

   at 307 K. This is a first order process with a rate constant of \(0.0827 \text{ s}^{-1}\) and a \(\Delta G^\circ\) value of \(-7791\ \text{J}\).

   How long will it take for the reaction to reach equilibrium when starting at standard conditions ([A] = 1.00 M, [B] = 1.00 M)?

2. Consider the molecule glucose-6-phosphate, an isomer of which is shown here, which is a major component of glycolysis:

   ![Glucose-6-phosphate structure]

   Determine the R or S conformation for C1, C2, and C3. What is the relationship between the two starred atoms (cis or trans)?

3. You are studying the reaction:

   \[2 \text{NO} (g) + \text{Cl}_2 (g) \rightarrow 2 \text{NOCl} (g)\]

   at 297 K. You have collected the following data:

   A plot of \(\ln(k)\) vs \((1/T)\) gave a straight line with the equation \(y = -2418.7\ (x) + 1.3408\). Additionally, the following initial rates were obtained:

<table>
<thead>
<tr>
<th>Experiment</th>
<th>[NO] (M)</th>
<th>[Cl₂] (M)</th>
<th>Rate of reaction (M/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.000100</td>
<td>0.000100</td>
<td>1.110e-07</td>
</tr>
<tr>
<td>2</td>
<td>0.000100</td>
<td>0.000200</td>
<td>2.221e-07</td>
</tr>
<tr>
<td>3</td>
<td>0.000200</td>
<td>0.000200</td>
<td>2.221e-07</td>
</tr>
</tbody>
</table>
What will the rate of the reaction be when the concentration of all reactants is 2.05 M and the reaction temperature is 333 K?

4. A concentration cell based on the following half reaction at 300 K

\[ \text{Ag}^+ + \text{e}^- \rightarrow \text{Ag} \quad \text{SRP} = 0.80 \text{ V} \]

has initial concentrations of 1.00 M Ag\(^+\) and 0.00 M Ag\(^+\). The reduction of the cathode is a first order process, with a rate constant of 0.000557 s\(^{-1}\). What will the potential of this cell be after 107 s?

What is the pH of a solution made by adding 0.40 g of NaOH to 100 ml of 0.4 M solution of CH\(_3\)COOH? Is it a buffering solution? Explain why or why not.

6. Consider the following molecules:

\[ \text{Cl} \quad \text{Cl} \quad \text{Cl} \quad \text{Cl} \]

\[ \text{OH} \quad \text{OH} \quad \text{F} \quad \text{Cl} \]

\[ \text{CO}_2 \quad \text{CO}_2 \quad \text{CO}_2 \quad \text{CO}_2 \]

a) Draw the corresponding conjugate bases

b). Rank the acids from most acidic to least acidic (assuming all solutions are the same concentration)