II. Problems: Please work the following problems in a logical fashion showing your work so that partial credit may be given:

1. (20 points) The rate of the reaction \(2 \text{HgCl}_2 + \text{C}_2\text{O}_4^{2-} \rightarrow 2 \text{Cl}^- + 2 \text{CO}_2 \ (g) + \text{Hg}_2\text{Cl}_2 \ (s)\) is followed by measuring the concentration of \(\text{Hg}_2\text{Cl}_2\) that precipitate per liter per minute.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>[\text{HgCl}_2] \ M</th>
<th>[\text{C}_2\text{O}_4^{2-}] \ M</th>
<th>Initial rate \ M/min</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.105</td>
<td>0.15</td>
<td>(1.8 \times 10^{-5})</td>
</tr>
<tr>
<td>2</td>
<td>0.105</td>
<td>0.30</td>
<td>(7.1 \times 10^{-5})</td>
</tr>
<tr>
<td>3</td>
<td>0.052</td>
<td>0.30</td>
<td>(3.5 \times 10^{-5})</td>
</tr>
<tr>
<td>4</td>
<td>0.052</td>
<td>0.15</td>
<td>(8.9 \times 10^{-5})</td>
</tr>
</tbody>
</table>

A. Determine the rate law for this reaction. (e.g. rate = \(k[A]^m[B]^n\)) You may assume \(m\) and \(n\) are integers.

\[
\text{rate} = k [\text{HgCl}_2]^1 [\text{C}_2\text{O}_4^{2-}]^2
\]

B. Determine the value of the rate constant:

\[
1.8 \times 10^{-5} \ \text{M/min} = k [0.105]^1 [0.15]^2
\]

\[
k = 7.62 \times 10^{-3} \ \frac{1}{\text{M}^2\text{min}}
\]

C. What would be the initial rate of the reaction if [\text{HgCl}_2] = 0.250 \ M and [\text{C}_2\text{O}_4^{2-}] = 0.450 \ M?

\[
\text{rate} = 7.62 \times 10^{-3} \ \frac{1}{\text{M}^2\text{min}} \ (0.250)^1 (0.450)^2
\]

\[
= 3.86 \times 10^{-4} \ \text{M/min}
\]