Solutions to prods 5-9

1. \( RCO_2H + R'NH_2 \rightarrow RCO_2^- + R'NH_3^+ \)
   \( pK_a \approx 5 \)
   \( K_{eq} = \frac{[RCO_2^-][R'NH_3^+]}{[RCO_2H][R'NH_2]} \)
   \( K_{eq} = \frac{10^{-5}}{10^{-10}} = 10^5 \)

   Look back at prob set 6, the last problem.

2. Compare the pHs of the conjugate acids of the leaving groups. In one line:

<table>
<thead>
<tr>
<th>Leaving GP</th>
<th>Conjugate acid</th>
<th>pHs</th>
</tr>
</thead>
<tbody>
<tr>
<td>H_3O</td>
<td>H_3PO_4</td>
<td>&lt; 0</td>
</tr>
<tr>
<td>R'NH_2</td>
<td>R'NH_3</td>
<td>&gt; 0</td>
</tr>
</tbody>
</table>

   A good leaving GP = conjugate base \( \approx \) a strong acid. \( H_3PO_4 \) is a stronger acid than \( R'NH_3 \). The more favorable process would be:

   \[ R + NH_4^+ \rightarrow R-NH_4^+ + H_2O \]

   So, it's a "bottleneck" in the overall scheme!