1. The chemical equation which describes how the weak acid $\text{HC}_2\text{H}_3\text{O}_2$ dissociates in aqueous solution is,

$$\text{HC}_2\text{H}_3\text{O}_2(aq) \rightleftharpoons \text{H}^+(aq) + \text{C}_2\text{H}_3\text{O}_2^-(aq)$$

a. In the data you obtained earlier (Acids, Bases and pH, pg. 55), the initial concentration of $\text{HC}_2\text{H}_3\text{O}_2$ is 0.100 M. In the space provided below (ICE Table), enter the initial concentration of $\text{HC}_2\text{H}_3\text{O}_2$, $\text{H}^+$, and $\text{C}_2\text{H}_3\text{O}_2^-$. Based on the measured pH of this solution, calculate and enter the equilibrium concentration of $\text{H}^+$.

$$\text{HC}_2\text{H}_3\text{O}_2(aq) \rightleftharpoons \text{H}^+(aq) + \text{C}_2\text{H}_3\text{O}_2^-(aq)$$

<table>
<thead>
<tr>
<th>Initial Concentrations</th>
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<tbody>
<tr>
<td>Change</td>
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<tr>
<td>Equilibrium Concentrations</td>
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b. Calculate the change in $[\text{H}^+]$.

c. Using the balanced chemical equation and the calculated change in $[\text{H}^+]$, calculate the change in $[\text{HC}_2\text{H}_3\text{O}_2]$ and $[\text{C}_2\text{H}_3\text{O}_2^-]$.

d. Calculate the equilibrium concentration of $\text{HC}_2\text{H}_3\text{O}_2(aq)$ and $\text{C}_2\text{H}_3\text{O}_2^-(aq)$. 
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e. Estimate the equilibrium constant for the dissociation of \( \text{HC}_2\text{H}_3\text{O}_2(aq) \).

f. Calculate the magnitude of the equilibrium constant for benzoic acid, \( \text{HC}_7\text{H}_5\text{O}_2 \), if a 0.100 M solution has a \( \text{pH} = 2.59 \).

g. Calculate the magnitude of the equilibrium constant for an aqueous solution of ammonia, if a 0.100 M solution has a \( \text{pH} = 11.13 \).

h. Calculate the \( \text{pH} \) of a solution which is 0.53 M \( \text{HC}_6\text{H}_4\text{NO}_2 \) (nicotinic acid). \( (K_a = 1.4 \times 10^{-5}) \)

i. Calculate the \( \text{pH} \) of a solution which is 0.712 M \( \text{CH}_3\text{NH}_2 \) (methylamine). \( (K_b = 4.4 \times 10^{-4}) \)