# UCI General Chemistry Department Peer Tutoring Review Session Feedback Evaluation

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Date</th>
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<tbody>
<tr>
<td>Class</td>
<td>Circle One</td>
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## Tutors’ Names

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree or Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<tbody>
<tr>
<td><strong>This review was interactive and engaging</strong></td>
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<td><strong>Comments</strong></td>
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<td><strong>Audience participation was encouraged.</strong></td>
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<td><strong>Comments</strong></td>
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<td><strong>The presentation volume was acceptable.</strong></td>
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<td><strong>Comments</strong></td>
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<td><strong>The presentation was visually clear and logically organized.</strong></td>
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<td><strong>Comments</strong></td>
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<td><strong>The review increased your confidence in taking your exam.</strong></td>
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<td><strong>Comments</strong></td>
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<td><strong>The quality of the review packet was excellent.</strong></td>
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<td><strong>Comments</strong></td>
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## ADDITIONAL QUESTIONS

- What worked best?
- What would you like to see next time?
- What could be improved?

## ADDITIONAL COMMENTS

- Tutor #1:
- Tutor #2:
Arasasingham Midterm 2 Review Packet

1. Methylammonium chloride is a salt of methylamine, CH₃NH₂. A 0.10 M solution of this salt has a pH of 5.82.
   a. Calculate the value for the equilibrium constant for the reaction
   \[ \text{CH}_3\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{NH}_2^- + \text{H}_3\text{O}^+ \]

   b. What is the Kb value for methylamine?

   c. What is the pH of a solution in which 0.450 mol of solid methylammonium chloride is added to 1.00 L of a 0.250 M solution of methylamine? Assume no volume change.

2. The degree of ionization of acetic acid, HC₂H₃O₂, in a 0.10 M aqueous solution at 25°C is 0.013. Ka at this temperature is 1.7 x 10⁻⁵. Calculate the degree of ionization of HC₂H₃O₂ in a 0.10 M solution at 25°C to which sufficient HCl is added to make it 0.010 M HCl. How is the degree of ionization affected?

3. Instructions for making up a buffer say to mix 60. mL (0.060 L) of 0.100 M NH₃ with 40. mL (0.040 L) of 0.100 M NH₄Cl. What is the pH of this buffer? The Kb is 1.8 x 10⁻⁵

   \[ \text{NH}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_4^+ (\text{aq}) + \text{OH}^- (\text{aq}) \]

4. What is the pH of a solution that is 0.10 M CH₃NH₂ (methylamine) and 0.15 M CH₃NH₃Cl (methylammonium chloride)? Kb= 4.4 x10⁻⁴

5. A buffer is prepared by adding 45.0 mL of 0.15 M NaF to 35.0 mL of 0.10 M HF. What is the pH of the final solution? Ka= 6.6 x 10⁻⁴
6. A weak acid solution containing 0.25 M of HA has a pH of 5.5.
   a) Calculate the $K_a$ value.
   b) Calculate the percent ionization of HA.

7. The conjugate base of an acid that ionizes once has a $K_b$ value of $5.0 \times 10^{-9}$. You take an amount of 0.80 M of the acid and place it in water. Calculate the pH of the solution at equilibrium.

8. You place two acids into a solution. One acid has a concentration of 0.50 M and is considered strong, and the other acid has a concentration of 0.50 M and a $K_a$ value of $3.5 \times 10^{-5}$. Both ionize only once in solution.
   a) Determine the concentration of [H+] each acid contributes at equilibrium.
   b) Calculate the pH of the solution at equilibrium.

9. Determine whether the following solutions will be acidic, basic, or nearly neutral when 1.0 mol of each is dissolved in 1.0 L of water:
   a) NH₄I
   b) KNO₂
   c) FeCl₃

10. Arrange the following 0.10 M solutions in order of decreasing acidity: BaCl₂, NaF, HI, LiOH, NH₄Cl

11. Calculate the molar solubility of PbCl₂ in pure water. $K_{sp}$ given as $1.17 \times 10^{-5}$

12. The molar solubility of Ag₂SO₄ in pure water is $1.2 \times 10^{-5}$ M. Calculate $K_{sp}$. 
13. What is the molar solubility of CaF₂ in a solution containing 0.100 M NaF? Ksp given as $1.46 \times 10^{-10}$.

14. A solution containing lead(II) nitrate is mixed with one containing sodium bromide to form a solution that is 0.0150 M in Pb(NO₃)₂ and 0.00350 M in NaBr. Does a precipitate form in the newly mixed solution?

15. The magnesium and calcium ions present in seawater ([Mg²⁺] = 0.059 M and [Ca²⁺] = 0.011 M) can be separated by selective precipitation with KOH. What minimum [OH⁻] triggers the precipitation of the Mg²⁺ ion?

16. Balance the following redox equations.
   a. $\text{Cu} + \text{HNO}_3 \rightarrow \text{Cu(NO}_3)_2 + \text{NO} + \text{H}_2\text{O}$

   b. $\text{Cr}_2\text{O}_7^{2-} + \text{HNO}_2 \rightarrow \text{Cr}^{3+} + \text{NO}_3^- \text{ (acidic)}$

   c. $\text{CNO}^- + \text{As}_2\text{O}_3 \rightarrow \text{CN}^- + \text{HAsO}_4^{2-} \text{ (basic)}$
17. You have 1.0 M solutions of Al(NO$_3$)$_3$ and AgNO$_3$ along with Al and Ag electrodes to construct a voltaic cell. The salt bridge contains a saturated solution of KCl.

\[
\begin{align*}
\text{Al}^{3+} + 3e^- & \rightarrow \text{Al} \quad E^o = -1.66 \text{ V} \\
\text{Ag}^+ + e^- & \rightarrow \text{Ag} \quad E^o = 0.80 \text{ V}
\end{align*}
\]

a. Identify the species undergoing oxidation and reduction.
b. Identify the oxidizing agent and the reducing agent.
c. Identify the anode and cathode, and write the appropriate half-reaction occurring at each electrode
d. Write the balanced overall reaction for the cell.
e. Indicate the direction of electron flow through the external circuit.
f. Calculate the standard cell potential.
g. Indicate the direction of ion flow in the salt bridge.

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<tr>
<th>Reduction Half-Reaction</th>
<th>$E^o$ (V)</th>
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<tr>
<td>Pb$^{2+}$ + 4e$^- \rightarrow$ Pb$^{0}$</td>
<td>1.80</td>
</tr>
<tr>
<td>Au$^{3+}$ + 3e$^- \rightarrow$ Au</td>
<td>1.50</td>
</tr>
<tr>
<td>Fe$^{3+}$ + 3e$^- \rightarrow$ Fe</td>
<td>0.771</td>
</tr>
<tr>
<td>I$^- + 2e^- \rightarrow$ 2 I</td>
<td>0.535</td>
</tr>
<tr>
<td>2 H$^+$ + 2e$^- \rightarrow$ H$_2$</td>
<td>0.00</td>
</tr>
<tr>
<td>Pb$^{2+}$ + 2e$^- \rightarrow$ Pb</td>
<td>$-0.124$</td>
</tr>
<tr>
<td>Al$^{3+}$ + 3e$^- \rightarrow$ Al</td>
<td>$-1.66$</td>
</tr>
<tr>
<td>Mg$^{2+}$ + 2e$^- \rightarrow$ Mg</td>
<td>$-2.37$</td>
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<tr>
<td>K$^+ + e^- \rightarrow$ K</td>
<td>$-2.93$</td>
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18. Use the table of standard reduction potentials shown above to answer the following:
a. Which is the strongest oxidizing agent?
b. Which is the strongest reducing agent?
c. Is I$^-$ able to reduce Mg$^{2+}$?
d. Is Fe$^{3+}$ able to oxidize Pb?
e. Will Au dissolve in an acidic solution?
f. Will Al dissolve in an acidic solution?
19. a. Calculate the standard free-energy change for the following reaction at 25°C: Au(s) | Au\(^{3+}\) (aq) || Ca\(^{2+}\) | Ca.

\[
\begin{align*}
\text{Au}^{3+} (aq) + 3e^- &\rightarrow \text{Au} (s) \quad E^\circ = 1.50 \text{ V} \\
\text{Ca}^{2+} (aq) + 2e^- &\rightarrow \text{Ca} (s) \quad E^\circ = -2.87 \text{ V}
\end{align*}
\]

b. The equilibrium constant for the reaction Sr (s) + Mg\(^{2+}\) (aq) ⇌ Sr\(^{2+}\) (aq) + Mg (s) is \(2.69 \times 10^{12}\) at 25°C. Calculate \(E^\circ\) for a cell made up of Sr/Sr\(^{2+}\) and Mg/Mg\(^{2+}\) half-cells.

c. Determine the equilibrium constant at 25°C for the following reaction: Zn + Ni\(^{2+}\) → Zn\(^{2+}\) + Ni.

\[
\begin{align*}
\text{Zn}^{2+} + 2e^- &\rightarrow \text{Zn} \quad E^\circ = -0.76 \text{ V} \\
\text{Ni}^{2+} + 2e^- &\rightarrow \text{Ni} \quad E^\circ = -0.23 \text{ V}
\end{align*}
\]

20. Consider an electrochemical cell with a copper electrode immersed in 1.0 M Cu\(^{2+}\) and a silver electrode immersed in 1.0 M Ag\(^+\).

\[
\begin{align*}
\text{Cu}^{2+} (aq) + 2e^- &\rightarrow \text{Cu} (s) \quad E^\circ = 0.34 \text{ V} \\
\text{Ag}^+ (aq) + e^- &\rightarrow \text{Ag} (s) \quad E^\circ = 0.80 \text{ V}
\end{align*}
\]

If \([\text{Cu}^{2+}]_0 = 0.0034 \text{ M}\) and \([\text{Ag}^+]_0 = 0.34 \text{ M}\), calculate \(E\) at 25°C.