I. Indicator Solutions

Name one indicator with two forms, and two similarly-colored wells. ____________________________

At which change in solution acidity does this indicator change forms:
(a) between acidic and neutral, or (b) between neutral and basic solutions?

Name an indicator with 2 forms, and 3 differently-colored wells because one well contains a mixture of both forms. ____________________________

Name one indicator with three forms, one prominent in each well. ____________________________

III. Cation Hydrolysis

<table>
<thead>
<tr>
<th>Salt</th>
<th>pH</th>
<th>Salt</th>
<th>pH</th>
<th>Salt</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>AlCl₃</td>
<td></td>
<td>CuCl₂</td>
<td></td>
<td>FeCl₃</td>
<td></td>
</tr>
<tr>
<td>LaCl₃</td>
<td></td>
<td>NaCl</td>
<td></td>
<td>ZnCl₂</td>
<td></td>
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</tbody>
</table>

IIIa. Hydrolysis of NaCl is expected to be negligible, the difference from pH 7.0 insignificant.

What difference did you find? pH of salt – 7.00 = __________

Is the pH of NaCl solution significantly different from neutral? Yes Maybe No

If significant, what dissolved gas might be responsible? ____________________________

IIIb. AlCl₃ and LaCl₃ differ only by cation size. What pH difference did you find, i.e. calculate

$\Delta pH = pH_{LaCl₃} - pH_{AlCl₃} = ________$

State the direction of a size effect if there is one.

IIIc. The cations of NaCl and LaCl₃ differ only in cation charge. What pH difference did you find? $\Delta pH = pH_{NaCl} - pH_{LaCl₃} = ________$

State the direction of a charge effect if there is one.
IIIb. Give a balanced equation for the hydrolysis of hydrated iron (III) ions in FeCl₃ solution.

Iron³⁺ is smaller than the ions compared above. Considering the effects of b through d, rationalize the pH of FeCl₃ solution.

IV. Basic Character of Anions
Molecular equation for (NH₄)₂CO₃(s) equilibrium: ________________________________

Net ionic equation for Na₂CO₃(aq) equilibrium: ________________________________

Which base, CO₃²⁻ or Cl⁻, is stronger by odor indication? by pH indication?

V. Fraction of Ionization
Greatest [H⁺]/cacid is _______ > median is _______ > least dissociated is _______

HCl equation

HC₂H₃O₂ equation

\[
10^\frac{[H^+]_{dil}/[H^+]_{init}}{[H^+]_{init}} \quad 10^\frac{[H^+]_{dil}/[H^+]_{init}}{[H^+]_{init}} \quad 10^\frac{[H^+]_{dil}/[H^+]_{init}}{[H^+]_{init}}
\]

for HCl for HOAc for buffer

acid of highest ratio _______ > median _______ > lowest ratio _______

Explain the highest or median case. Realize that \(10^\frac{[H^+]_{dil}/[H^+]_{init}}{[H^+]_{init}}\) is also \(\frac{[H^+]_{dil}/c_{dil}}{[H^+]_{init}/c_{init}}\).

VI. Buffering
Which solution showed the biggest pH increase with a single drop of 0.1 M NaOH?

Which tube would become basic with the fewest drops?

What was the buffer capacity (in drops)?

In Part VI the pH increases with each drop NaOH added; in Part I the indicator did not change color with each drop. Explain how solutions of different acidity can have the same indicator color.