Supplemental Questions

6. One of the benefits of aeration in purification of drinking water is that it oxidizes water soluble Fe^{2+}.
   a. What pH conditions would favor removal of iron? ($K_{sp}(Fe(OH)_3) = 2.0 \times 10^{-39}$)
   b. What is the maximum residual amount of iron (ppm) that could be present in a thoroughly aerated water sample at pH 8.0?
   c. Assume that the rate of oxidation from Fe^{2+} to Fe^{3+} is given by the equation below.
      What is the half-life of Fe^{2+} at pH 8.0?
      \[
      \text{Rate} = 7.2 \times 10^{13} [Fe^{2+}] [OH^-] p(O_2) L^2 \text{ mol}^{-2} \text{ atm}^{-1} \text{ min}^{-1}
      \]
      \textbf{Note: Assuming [OH^-] and pO_2 are constant, the rate equation is pseudo first order}

7. Carbon tetrachloride is a relatively common halogenated hydrocarbon that is moderately toxic. A long-term study using rats shows that below 0.311 mg per day of ingested carbon tetrachloride there was no evidence of toxic response.
   a. Assuming the average rat weighs 439 g, calculate the NOEL and ADI (RfD) values that would correspond to the data found in this study.
   b. Calculate the maximum recommended daily dose for a 22 kg child.
   c. Why might the ADI (or RfD) value be set at an even lower value for young children than for adults?
8. For efficient disinfection to occur, treated drinking water should contain about 0.5 mg L\(^{-1}\) of Cl\(_2\) that remains after most of the chlorine has been converted to HOCl. What pressure of Cl\(_2\)(g) is required to maintain this concentration? The value of Henry’s Law constant for Cl\(_2\) in water is 8.0 \(\times\) 10\(^{-3}\) M atm\(^{-1}\).

9. In a DDT biomagnification study the bioconcentration factors (BCF) for the links in a food chain were determined.

<table>
<thead>
<tr>
<th>Links</th>
<th>BCF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water → Zooplankton</td>
<td>800</td>
</tr>
<tr>
<td>Zooplankton → Fish A</td>
<td>30</td>
</tr>
<tr>
<td>Fish A → Fish B</td>
<td>2</td>
</tr>
<tr>
<td>Fish B → Seagull</td>
<td>5</td>
</tr>
</tbody>
</table>

a. What is the overall biomagnification that occurs from water to seagulls?

b. If the water started with 4.7 \(\times\) 10\(^{-3}\) mg/mL DDT, what is the concentration in the tissue of Fish B?

c. If a seagull had 136 ppm DDT in its tissue, what is the concentration expected in the zooplankton?

10. For efficient disinfection to occur, treated drinking water should contain about 0.5 mg L\(^{-1}\) of Cl\(_2\) that remains after most of the chlorine has been converted to HOCl. What pressure of Cl\(_2\)(g) is required to maintain this concentration? The value of Henry’s Law constant for Cl\(_2\) in water is 8.0 \(\times\) 10\(^{-3}\) M atm\(^{-1}\).