Chemistry 152: Equilibrium Problems to work in quiz section on week 1

1. Given the following reaction quotient:

\[ Q = \frac{[CO_2]^2 [H_2O]^2}{[C_2H_4][O_2]^3} \]

What is the balanced reaction from which this quotient was derived?

2. The interhalogen complex ClF₃ is prepared in a two-step process:

\[ Cl_2(g) + F_2(g) \rightleftharpoons ClF(g) \]

\[ ClF(g) + F_2(g) \rightleftharpoons ClF_3(g) \]

a) Balance each step and write the overall reaction.

b) Show that Q for the overall reaction is equal to the product of the Qs derived from each individual step.

3. For the following weak acid equilibrium (Kₐ (H₃PO₄) = 7.5 x 10⁻³):

\[ H_3PO_4 + H_2O \rightleftharpoons H_2PO_4^- + H_3O^+ \]

What is the pH of a solution where the initial concentration of H₃PO₄ is 0.25 M and of H₂PO₄⁻ is 0.5 M?

4. In the titration of 50 mL of 0.1 M HCl, you are at the point where you have added 25 mL of 0.1 M NaOH. What is the pH of the solution at this point?

5. Given the following ionic compounds and their K_{sp}:

<table>
<thead>
<tr>
<th>Compound</th>
<th>K_{sp}</th>
</tr>
</thead>
<tbody>
<tr>
<td>BaF₂</td>
<td>1.7 x 10⁻⁶</td>
</tr>
<tr>
<td>PbI₂</td>
<td>1.4 x 10⁻⁸</td>
</tr>
<tr>
<td>Fe(OH)₂</td>
<td>1.6 x 10⁻¹⁴</td>
</tr>
</tbody>
</table>

Circle the one that has the greatest solubility.

6. In a 0.05 M solution of KI saturated with PbI₂, what will be the concentration of Pb^{2+}?