Name:____________________

Blk:______Date:______________

Chemistry 12

Solubililty Lesson #7

PREDICTING WHETHER A PRECIPITATE WILL FORM

In this section you are asked to determine if when you mix two solutions containing ions whether or not a precipitate will form. This is commonly called the **TRIAL ION PRODUCT** Calculation or **"TIP" (LIKE A TRIAL Keq)**

Q = The value obtained using the GIVEN ION concentrations

Ksp = The value obtained when using Ion concentrations in a SATURATED SOLUTION

There are **THREE POSSIBLE OUTCOMES** once you have calculated the Trial Ion Product:

A. **Q < Ksp**

Here we have less than what is needed for a saturated solution so the result is:

NO A PPT WILL NOT FORM

B. **Q =Ksp**

Here we have just enough for a saturated solution so the result is:

A MINIMUM AMOUNT OF PPT WILL FORM

∴ a possible ppt may form
- "just start"
- "max amount added w/out forming a ppt"

C. **Q > Ksp**

Here we have more than what is needed for a saturated solution so the result is:

YES A PPT WILL FORM

Example 1: Will a precipitate form when 5.0 mL of 6.0 x 10^{-5} M Ag^+ mixes with 10.0 mL of 4.2 x 10^{-6} M Cl^- ?

1st: $AgCl_{(s)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)}$

2nd: $K_{sp} = [Ag^+][Cl^-] = 1.8 \cdot 10^{-10}$; "Q" $= [Ag^+]_G[Cl^-]_G$

3rd: Calculate $[\ ]_G$

$[Ag^+] = \frac{6.0 \cdot 10^{-5} M \cdot 0.0050 L}{0.0150 L} = 2.0 \cdot 10^{-5} M\ Ag^+$ "Q" ; $[Cl^-]_G = \frac{4.2 \cdot 10^{-6} M \cdot 0.0100 L}{0.0150 L} = 2.8 \cdot 10^{-6} M\ Cl^-$ Ksp

4th: "Q" $= [2.0 \cdot 10^{-5}][2.8 \cdot 10^{-6}] = 5.6 \cdot 10^{-11} < 1.8 \cdot 10^{-10}$ no ppt

$1\ Pb(NO_3)_2 \rightarrow Pb^{2+} + 2NO_3^-$ $1MgI_2 \rightarrow 1Mg^{2+} + 2I^-$

Example 2: If 25.0 mL of 4.50 x 10^{-3} M $Pb(NO_3)_2$ is mixed with 35.0 mL of 2.80 x 10^{-3} M MgI_2, will a precipitate form?

1st: $Pb(NO_3)_2(aq) + MgI_2(aq) \rightarrow PbI_2(s) + Mg(NO_3)_2(aq)$

$PbI_2(s) \rightleftharpoons Pb^{2+}(aq) + 2I^-(aq)$

2nd: $Ksp = [Pb^{2+}][I^-]^2 = 8.5 \cdot 10^{-9}$ (table)

$"Q" = [Pb^{2+}]_G [I^-]_G^2$

$[I^-]_G = 2 \cdot \frac{2.80 \cdot 10^{-3} M \cdot 0.0350 L}{0.0600 L} = 3.27 \cdot 10^{-3} M\ I^-$

3rd:

$[Pb^{2+}]_G = \frac{4.50 \cdot 10^{-3} \cdot 0.0250 L}{0.0600 L} \approx 1.88 \cdot 10^{-3} M\ Pb^{2+}$

4th: $"Q" = [1.88 \cdot 10^{-3}][3.27 \cdot 10^{-3}]^2$

$= 2.00 \cdot 10^{-8} \geq 8.5 \cdot 10^{-9}$

yes a ppt will form

Example 3. What [Cl^-] is required to JUST START precipitation of AgCl (s) from a 3.6 x 10^{-3} M solution of Ag^+ ? $Q = Ksp$

1st: $AgCl(s) \rightleftharpoons Ag^+(aq) + Cl^-(aq)$

2nd: $Ksp = [Ag^+][Cl^-] = 1.8 \cdot 10^{-10}$

3rd: $"Q" = "Ksp"$

$\frac{1.8 \cdot 10^{-10}}{3.6 \cdot 10^{-3}} = \frac{[3.6 \cdot 10^{-3}][x]}{3.6 \cdot 10^{-3}}$

4th:

$5.0 \cdot 10^{-8} = [x]$

$\therefore 5.0 \cdot 10^{-8}$ M Cl^- will just start a ppt

Seatwork/Homework:Exercises 57 - 69 pgs 98-99 (odd numbers only)

PLO's :I5 - I6