Solubility Product Lab Calculation Help

Part III:

M of $Na_2S_2O_3$:

molarity of your KIO_3 soln

$$0.010\ L\ KIO_3 \times \frac{mol\ KIO_3}{L\ KIO_3} \times \frac{3\ mol\ I_2}{1\ mol\ KIO_3} \times \frac{2\ mol\ S_2O_3^{2-}}{mol\ I_2}$$

$$= moles\ S_2O_3^{2-}$$

You pipetted 10 mL of your KIO_3 Soln.

$$\frac{moles\ S_2O_3^{2-}}{L\ S_2O_3^{2-}\ added} = M\ S_2O_3^{2-} = M\ Na_2S_2O_3$$

Part IV:

moles IO_3^-:

molarity of your $Na_2S_2O_3$ soln.

$$L\ S_2O_3^{2-}\ added \times \frac{moles\ S_2O_3^{2-}}{L\ S_2O_3^{2-}} \times \frac{1\ mol\ I_2}{2\ mol\ S_2O_3^{2-}} \times \frac{1\ mol\ IO_3^-}{3\ mol\ I_2}$$

$$= moles\ IO_3^-$$

amount of $Na_2S_2O_3$ Soln. needed to reach endpoint

Solubility of $Ca(IO_3)_2$ in pure water:

$$\frac{moles\ IO_3^-}{} = M\ IO_3^- = 2s$$

endpoint

Solubility of $Ca(IO_3)_2$ in pure water:

$$\frac{moles\ IO_3^-}{0.010L\ IO_3^-} = M\ IO_3^- = 2s$$

$$S = Solubility = \frac{M\ IO_3^-}{2}$$

You should have pipetted 10 mL $Ca(IO_3)_2$ Soln.

Stoichiometry. Since its $Ca(IO_3)_2$, you would have $2\ IO_3^-$ for every $1\ Ca(IO_3)_2$ that dissolved.

Part V:

Moles IO_3^-:

$$L\ S_2O_3^{2-} \times \frac{\text{moles } S_2O_3^{2-}}{L\ S_2O_3^{2-}} \times \frac{1 \text{ mol } I_2}{2 \text{ mol } S_2O_3^{2-}} \times \frac{1 \text{ mol } IO_3^-}{3 \text{ mol } I_2} = \text{moles } IO_3^-$$

molarity of your $Na_2S_2O_3$ soln.

amount of $Na_2S_2O_3$ soln. needed to reach endpoint

Solubility of $Ca(IO_3)_2$ in Sat. 0.01 M KIO_3:

$$\frac{\text{moles } IO_3^-}{0.010\ L\ IO_3} = M\ IO_3^- = 0.01 + 2S$$

Existing 0.01 M IO_3^- from the KIO_3

$$S = \frac{(M\ IO_3^- - 0.01)}{2}$$

10 mL of $Ca(IO_3)_2$ in 0.01 M KIO_3 soln. you pipetted

Stoichiometry from 2 IO_3^- from every 1 $Ca(IO_3)_2$

Ksp based on concentration:

Ksp of $[Ca(IO_3)_2]$ in pure water: (from part IV)

$$Ca(IO_3)_{2\,(s)} \rightleftharpoons Ca^{2+}{}_{(aq)} + 2\ IO_3^-{}_{(aq)}$$

$$K_{sp} = [Ca^{2+}][IO_3^-]^2 = (s)(2s)^2 = 4s^3$$

you calculated this S in part IV

Ksp of $[Ca(IO_3)_2]$ in Sat. 0.01 M KIO_3: (from part V)

$$K_{sp} = [Ca^{2+}][IO_3^-]^2 = (s)(2s)^2 = 4s^3$$

you ... in part IV

Ksp of $[Ca(IO_3)_2]$ in Sat. 0.01 M KIO_3: (from part V)

$$Ca(IO_3)_{2\,(s)} \rightleftharpoons Ca^{2+}{}_{(aq)} + 2\ IO_3^-{}_{(aq)}$$

$$K_{sp} = [Ca^{2+}][IO_3^-]^2 = (s)(0.010\ M + 2s)^2$$

You calculated this S in part V

due to the 0.01 M KIO_3

K_{sp} based on activity:

Note: The activity Coefficients you need for the ionic strength of the Solns. you worked with can be found in table 1 of this exp. in your lab manua

$Ca(IO_3)_2$ in pure Water:

Ionic Strength:

$$\mu = \frac{1}{2}\left([Ca^{2+}](2)^2 + [IO_3^-](1)^2 \right) = \frac{1}{2}\left(4s + 1(2s)\right) = 3s$$

K_{sp} using activities:

Based on the μ that you just calculated, look up $\gamma_{Ca^{2+}}$ & $\gamma_{IO_3^-}$

$$K_{sp} = \gamma_{Ca^{2+}}[Ca^{2+}]\,\gamma_{IO_3^-}^2[IO_3^-]^2$$

$$= \gamma_{Ca^{2+}} + \gamma_{IO_3^-}^2 (s)(2s)^2$$

$$= 4\gamma_{Ca^{2+}} + \gamma_{IO_3^-}^2 (s^3)$$

$Ca(IO_3)_2$ in Sat. 0.01 M KIO_3:

Ionic Strength:

$$\mu = \frac{1}{2}\left([K^+](1)^2 + [Ca^{2+}](2)^2 + [IO_3^-](1)^2\right)$$

$$= \frac{1}{2}\left(1(0.01) + 4s + 1(0.01 + 2s)\right)$$

K_{sp} Using activities:

Again, look up $\gamma_{Ca^{2+}}$ and $\gamma_{IO_3^-}$ based on the μ that you Calculated

$$K_{sp} = \gamma_{Ca^{2+}}[Ca^{2+}]\,\gamma_{IO_3^-}^2[IO_3^-]^2$$

$$= \gamma_{Ca^{2+}} + \gamma_{IO_3^-}^2 (s)(0.01\,M + 2s)^2$$

Again, look up $\gamma_{Ca^{2+}}$ and $\gamma_{IO_3^-}$ based on the μ that you calculated

$$K_{sp} = \gamma_{Ca^{2+}}[Ca^{2+}]\,\gamma_{IO_3^-}^2[IO_3^-]^2$$

$$= \gamma_{Ca^{2+}} + \gamma_{IO_3^-}^2 (s)(0.01\,M + 2s)^2$$