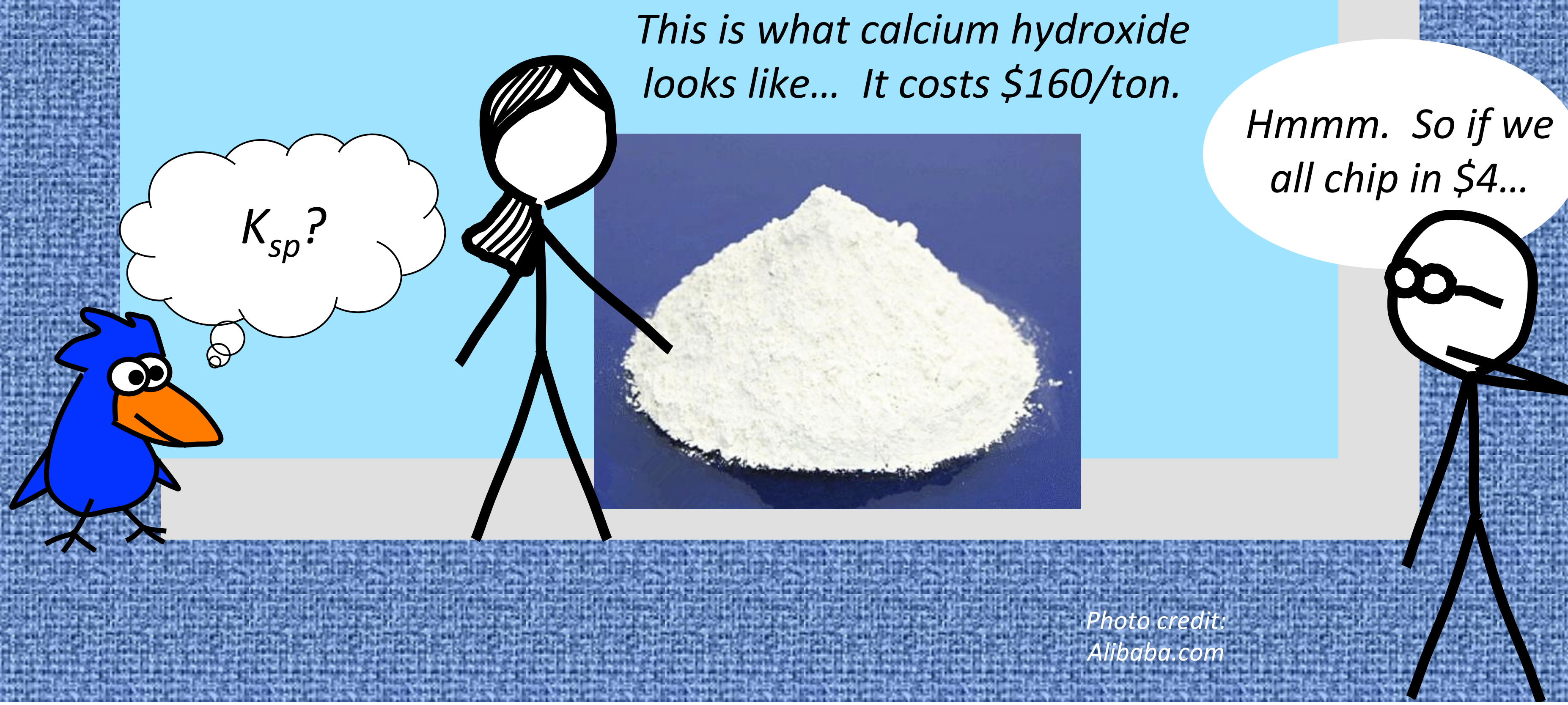
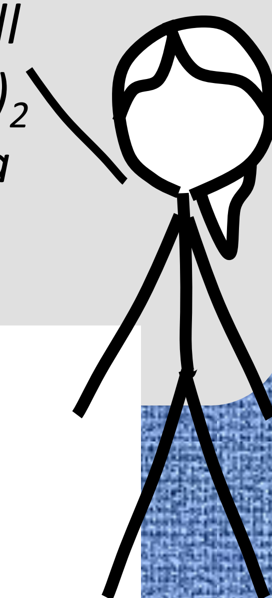
# Determination of $K_{sp}$ for Calcium Hydroxide
# 20 February 2020

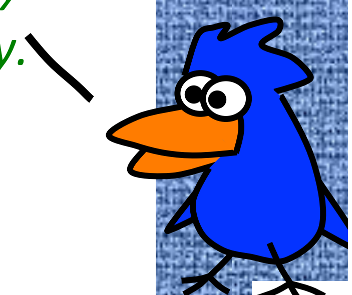


# Objectives: To determine a useful value: an equilibrium constant.

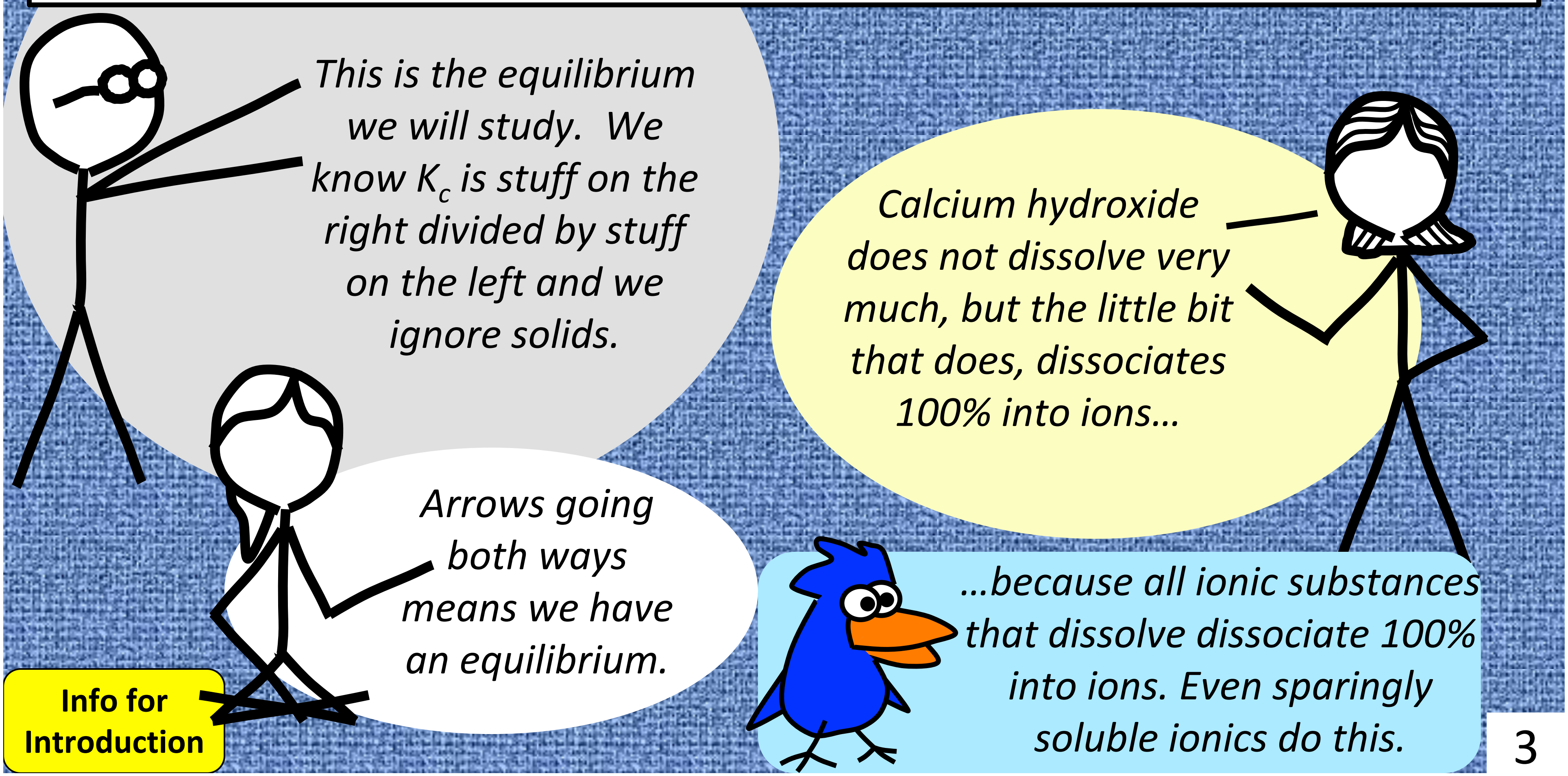

## Overview:

1. The equilibrium constant of a sparingly soluble ionic solid.
2. Overview of the experiment and calculations.
3. The titration
4. Procedure: What we do today
5. Your lab report



# 1. The equilibrium constant of a sparingly soluble ionic solid.

$$Ca(OH)_2(s) \rightleftharpoons Ca^{2+}(aq) + 2\ OH^-(aq) \qquad K_c = [Ca^{2+}][OH^-]^2$$

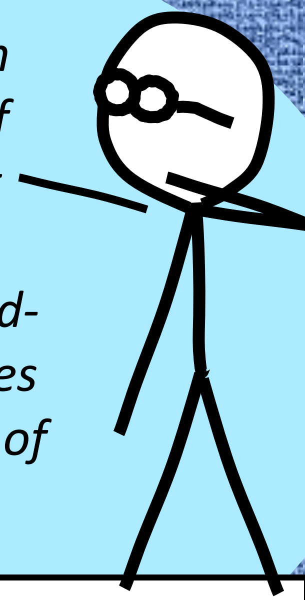


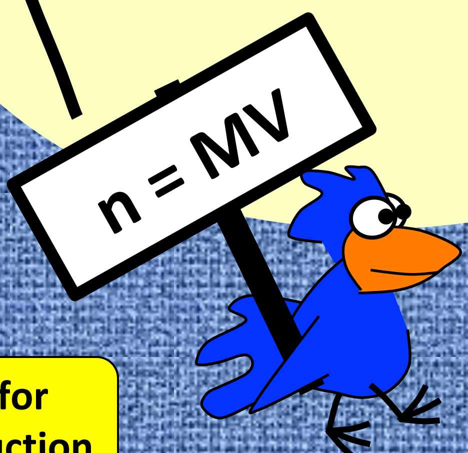
# 2. Overview of the experiment and calculations

$Ca(OH)_2(s) \rightleftharpoons Ca^{2+}(aq) + 2\ OH^-(aq)$ $K_c = [Ca^{2+}][OH^-]^2$

*If we titrate the $OH^-$ with a known concentration of HCl(aq), we can figure out moles of HCl used by using $n_{acid} = M_{acid}V_{acid}$.*

*And from there we can figure out the moles of $OH^-$ that were present from the 1:1 stoichiometry of the acid-base titration. The moles of $OH^-$ equals the moles of $H_3O^+$, $n_{base} = n_{acid}$.*






$H_3O^+(aq) + OH^-(aq) \rightarrow 2\ H_2O(l)$

**Info for Introduction**

# 2. Overview of the experiment and calculations

$$Ca(OH)_2(s) \rightleftharpoons Ca^{2+}(aq) + 2\ OH^-(aq) \qquad K_c = [Ca^{2+}][OH^-]^2$$

*Here's our "road map". From moles of $OH^-$, we get the molarity of $OH^-$. That gives us $[Ca^{2+}]$ from the 2:1 stoichiometry. With $[OH^-]$ and $[Ca^{2+}]$ we calculate $K_c$! Easy peasy.*

$$n_{OH^-} = n_{H_3O^+}$$

$$[OH^-] = \frac{n_{OH^-}}{V_{\text{original } Ca(OH)_2 \text{ Sol'n}}}$$


$$[Ca^{2+}] = \frac{[OH^-]}{2}$$

$$K_c = [Ca^{2+}][OH^-]^2$$

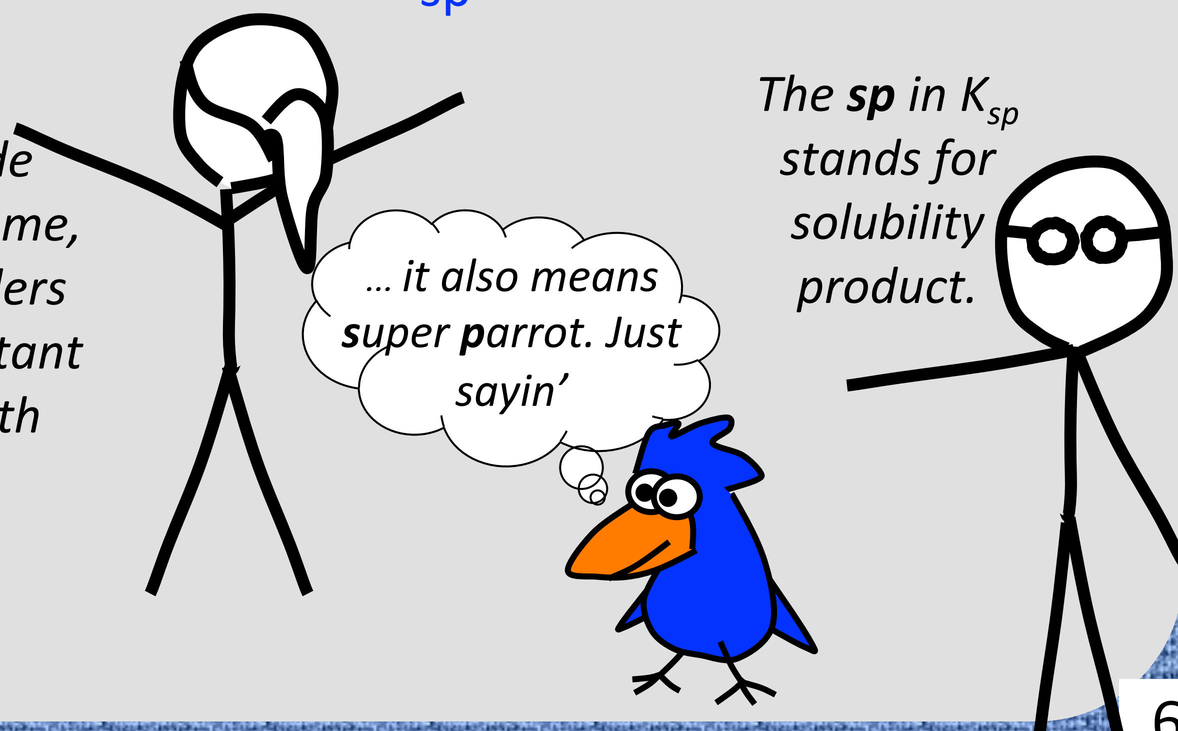
**Info for Introduction**

# 2. Overview of the experiment and calculations

$Ca(OH)_2(s) \rightleftharpoons Ca^{2+}(aq) + 2\ OH^-(aq)$   $K_{sp} = [Ca^{2+}][OH^-]^2$

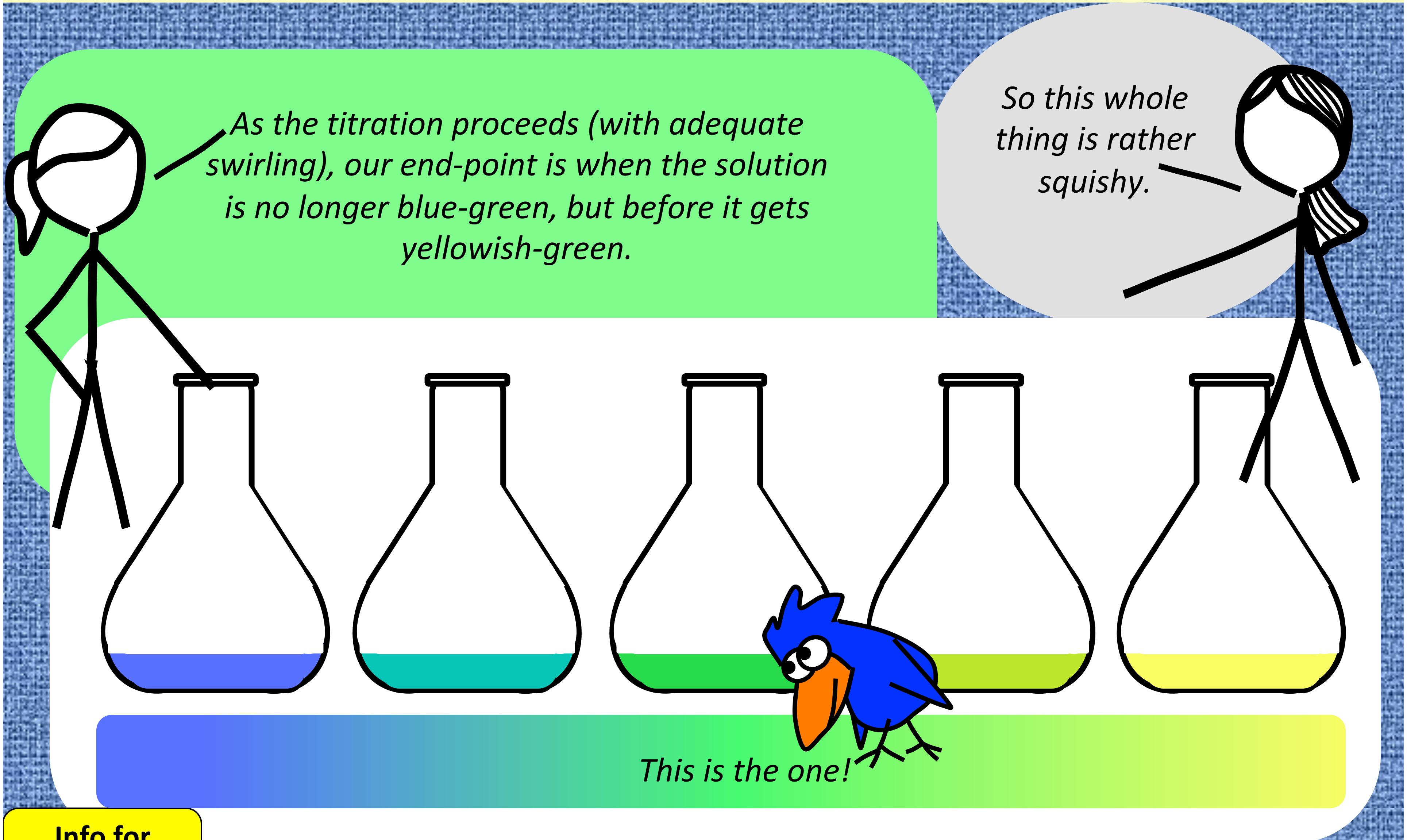
$K_c = [Ca^{2+}][OH^-]^2$ or $K_{sp} = [Ca^{2+}][OH^-]^2$

*Here is the simplest slide ever! $K_c$ is given a new name, $K_{sp}$ – just to remind readers that the equilibrium constant has something to do with solubility.*



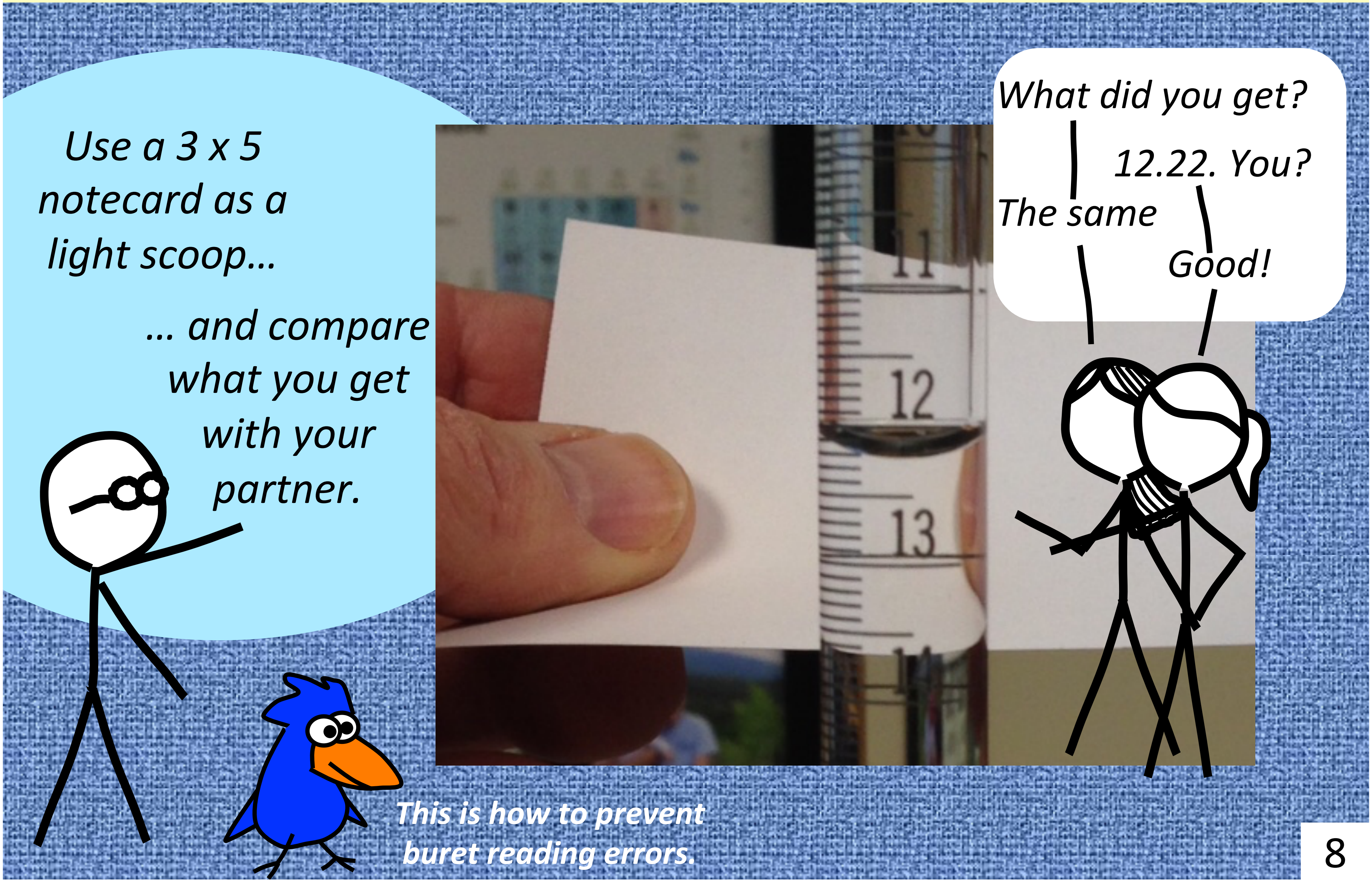

**Info for Introduction**

# 3. The titration

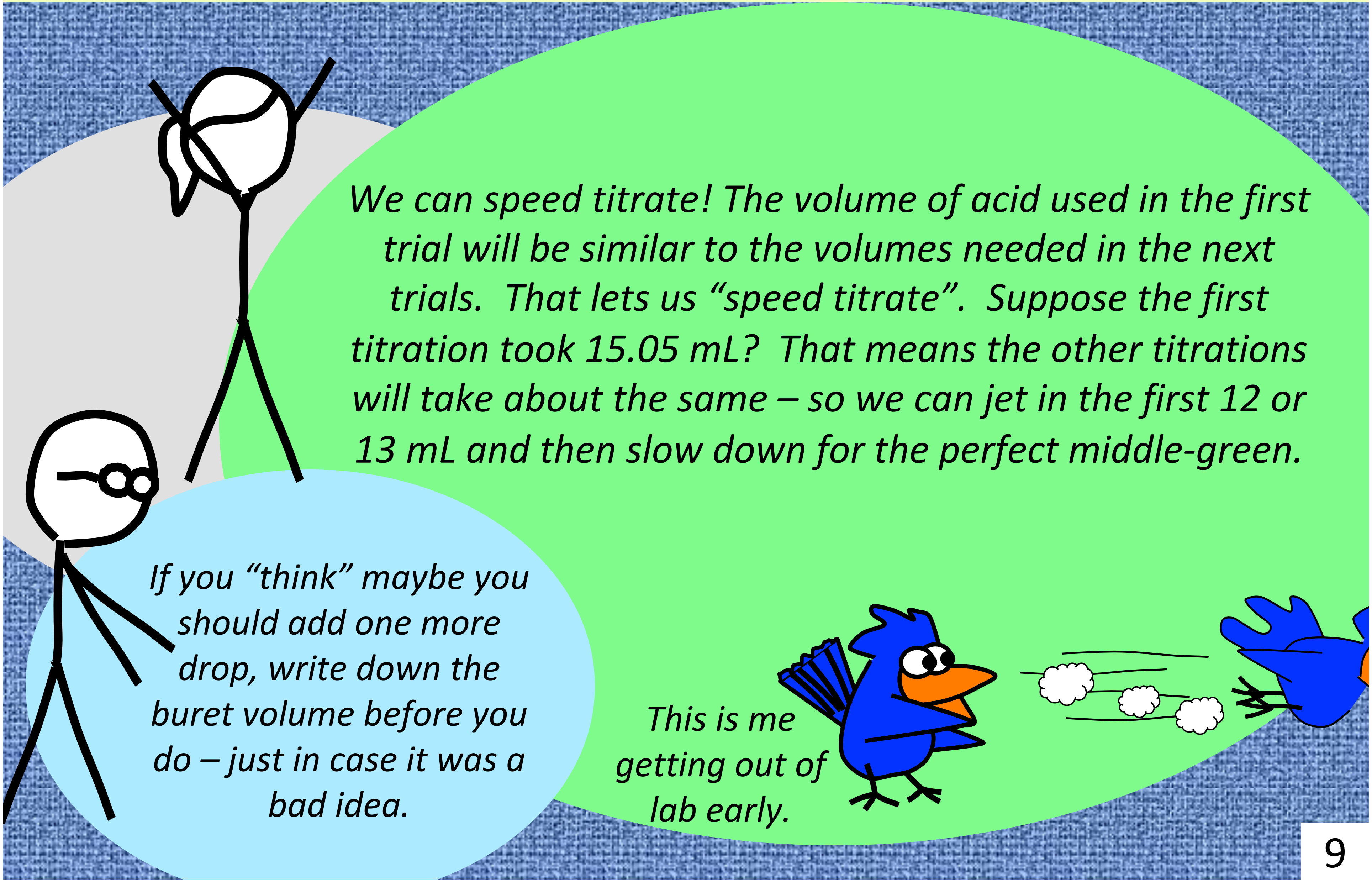



**Info for Introduction**

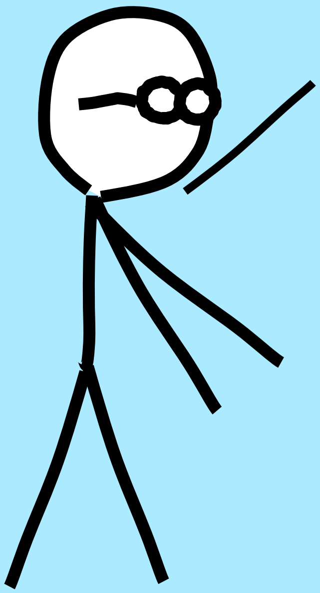
# 3. The titration



# 3. The titration



# 4. Procedure: What we do today



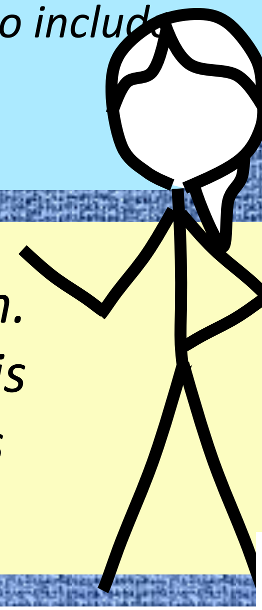
① *Take time writing an introduction in your own words before lab.*

② *Record observations and details as carefully as possible. Show your calculations with formulas, units, and significant figures!*

③ *After the first titration is done, the subsequent titrations will take about the same volume of HCl(aq).*

④ *Compare your $K_{sp}$ with the literature value (from our textbook or the internet). Cite your reference.*

⑤ *The cover sheet summarizes everything that you need to include with your report.*




*You'll be entering data into a Google form. Exponential numbers are entered as in this example: 8.00 x $10^{-6}$ would be entered as* ***8.00E-6*** *– note there are no spaces!*

# 5. Your lab report


① First, the cover page with TA initials.

② Next, the trimmed copy pages from your lab notebook stapled together. Staple all together.

③ **On-line results** due at the end of class today. Late submissions are not graded – see the syllabus.

④ No attached pages today.

⑤ Turn in lab report today or ***before*** the start of class tomorrow. Late labs may not be graded – see the syllabus.