EXPERIMENT 2

Stoichiometry of a Chemical Reaction

$CuSO_4$ + NaOH

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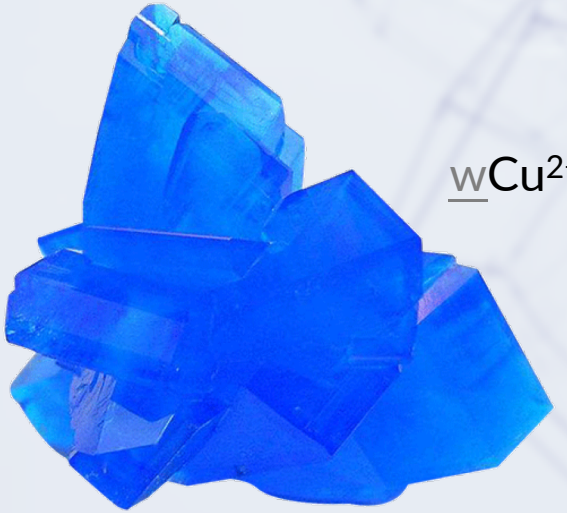
CHEMISTRY 136L

YALE UNIVERSITY

FALL 2018



$CuSO_4$

CHEMICAL REACTION

$$w Cu^{2+}(aq) + x SO_4^{2-}(aq) + y Na^{+}(aq) + z OH^{-}(aq) \rightarrow \text{??? } (s) + \text{??? } (aq)$$

Q: What is the formula of the precipitate?
Q: What are the values of w, x, y, and z?

How can we determine these answers?

METHOD OUTLINE: VOLUMETRIC TITRATION

Prepare a standard solution of $CuSO_4$:

Dissolve a known accurate mass of $CuSO_4 \cdot 5H_2O$ in a known accurate volume of solution.

+

A standardized solution of NaOH of known concentration will be provided.

METHOD OUTLINE: VOLUMETRIC TITRATION

Take an accurate volume (a 10 mL or 5 mL graduated pipet)
of BLUE copper sulfate solution.

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Add phenolphthalein indicator. → Stir with stir bar.
Heat to ~70 °C and remove from hot plate.

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While stirring: From buret, add COLORLESS NaOH to hot copper sulfate solution.

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Stop adding NaOH when solution turns PALE PINK.

↓

Moles of Cu^{2+} is known (volume × concentration)
Moles of OH^- is also known.
→ Cu^{2+} : OH^- mole ratio in precipitate can be figured out.

Use experimental Cu^{2+} : OH^- mole ratio and charge balance principle to figure out formula of the precipitate.

↓

Figure out the complete balanced reaction.
Figure out the net ionic equation.

Q: Can we test for "complete" precipitation of all Cu^{2+} from the solution?

Testing with S^{2-}:
CuS is **BLACK** and insoluble in water (K_{sp} = 8 × 10^{-37})

Do this testing in the fume hood!
When done, dispose right away in labeled waste container in the same fume hood.
Do NOT bring it to your work station.
H_2S is a toxic **COLORLESS** gas.

LAB REPORTS

Purpose Section	10 points
Results & Calculations Section (including graphs)	30 points
Answers to Questions	5 points
Datasheets	5 points

Lab report is due next week → Submit in Canvas as a **PDF**.
Report Pages are in Canvas.
Include pictures/scans of your datasheets to the end of your lab report.

Academic honesty

CLEAN UP YOUR WORK AREA. WASH HANDS.
CHECK WITH DR. HUYNH BEFORE YOU LEAVE.