

TITLE

Investigation of a Solution's Color (Qualitative)

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COURSE

General Chemistry II

TYPE

Guided-Inquiry Activity

TEACHING MODE

Facilitated group inquiry *or* individual pre-lab assignment

LEARNING GOALS

Students will be able to:

- Describe the relationship between solution concentration and color intensity for various metal ions

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INVESTIGATION OF A SOLUTION'S COLOR

A beverage company does not know why their product has an inconsistent color that changes over time, and from batch to batch. You have been contacted because no one within the company has the background conceptual knowledge to understand the factors that affect the intensity of color. It has sent you a drink mix sample and various chemical compounds in solid form and as solutions. To investigate them you have a concentration probe and a visible-light spectrometer.

GETTING STARTED

Download the sim: <http://phet.colorado.edu/en/simulation/concentration>

Explore all of the controls in the sim for 5 minutes.

CONCENTRATION TAB

- Identify 2 (or more) ways that you can accomplish the following actions in the simulation:
 - Change the solution volume
 - Change the number of moles of solute
 - Change the molarity of the solution

- Complete the table

Compound	Formula	Color	What particles (ions, molecules, etc.) are in the aqueous solution?
Drink mix	---		??
Cobalt (II) nitrate			
Cobalt chloride			
Potassium dichromate			
Potassium chromate			
Nickel (II) chloride			
Copper sulfate			
Potassium permanganate			

- Can the cation affect the color of a solution? Can the anion affect the color of a solution? Provide supporting evidence for each case.

Commented [YC1]: An alternate version of this activity is also available online which builds on these concepts and extends to spectroscopic techniques and quantitative relationships between absorbance between concentration

4. Several different batches of drink mix have different appearances. The solution is supposed to be somewhat red in color, but that is not always the case. What do you think went wrong? Provide a plausible reason, consistent with the observations.

Scenario 1: The color intensity is too low – it is too pale.

Scenario 2: The color intensity is too great – it is too dark.

Scenario 3: The solution color is wrong! It looks somewhat blue.

Scenario 4: The vat of solution started out with the correct color intensity, but over time the appearance changed. The employees are certain nothing was added to the open vat.