

The Molarity simulation allows students to qualitatively and quantitatively explore the relationships between solute amount, solution volume, and solution concentration.

The screenshot shows the PhET Molarity simulation interface. On the left, there are two vertical sliders: 'Solute Amount (moles)' with a scale from 'none' to 'lots', and 'Solution Volume (Liters)' with a scale from 'low' to 'full'. In the center is a beaker labeled 'Drink mix' containing a red liquid. To the right is a vertical color scale for 'Solution Concentration (Molarity)' ranging from 'zero' (white) to 'high' (red). Below the beaker is a dropdown menu for 'Solute' currently set to 'Drink mix'. At the bottom left is a checkbox for 'Show values'. On the right side, there is a list of solutes with corresponding color swatches: Drink mix (red), Cobalt (II) nitrate (orange), Cobalt chloride (yellow), Potassium dichromate (green), Gold (III) chloride (blue), Potassium chromate (purple), Nickel (II) chloride (brown), Copper sulfate (pink), and Potassium permanganate (dark purple). Callout boxes point to these elements with the following text:

- ADD or remove solute.** (points to the Solute Amount slider)
- INCREASE or decrease solution volume.** (points to the Solution Volume slider)
- SHOW or hide values for moles, liters and molarity.** (points to the 'Show values' checkbox)
- MEASURE solution concentration.** (points to the Solution Concentration scale)
- CHOOSE solute.** (points to the Solute dropdown menu)

Insights into Student Use

- We recommend using the sim to help students determine qualitative relationships between molarity, moles, and liters before having students complete quantitative problems or data collection.
- The sim demonstrates saturation but does not explain why different solutes have different solubilities. In interviews, students were able to connect saturation to the idea of having “more solute than water can dissolve”. Our Concentration simulation addresses the topic of saturation in more detail.
- The Drink Mix example provides a real-world link to the concept of concentration to help students make connections to the chemical examples.

Model Simplifications

- Solution volume is the combined volume of solute and water.
- By design, not all solutions will reach saturation. The number of moles that can be added is limited to the range of 0.2-1.0 moles so that students can explore some solutions for the full concentration range (0-5 M).
- Drink mix is assumed to have the same solubility as sucrose.
- Solubility of each solution listed was calculated at 25°C, except for AuCl_3 and Drink mix, which were based on data taken at 20°C.



Suggestions for Use

Sample Challenge Prompts

- Explain the relationship between solute amount and solution concentration.
- Describe what happens to the concentration of a solution as solution volume is increased but the amount of solute remains constant.
- Determine three different sets of solute amounts and solution volumes that can be used to make a solution with a concentration of 0.75 M.
- Write a mathematical expression to show how molarity is calculated.
- What is a saturated solution?
- Explain why the concentration of a solution does not change once the solution has reached saturation.
- Find another PhET sim that helps you understand molarity and saturation.

See all activities for Molarity [here](#).

For more tips on using PhET sims with your students, see [Tips for Using PhET](#).