

Module 8.5: Molarity

Background

- [EPA Announces Historic Plan to Regulate Toxic PFAS Chemicals](#) (LO 8.5.2)
 - Description: This news article with embedded video reports on EPA plans to regulate PFAS chemicals, such as GenX, which contaminated the Cape Fear River in Wilmington, NC. EPA recently established health advisory levels at 70 parts-per-trillion (ppt). Although this module focuses on molarity as a unit of concentration, you might consider introducing the ppt unit and comparing it to the health advisory levels for other pollutants.
 - License: By Ben Smart for WECT News February 14, 2019

Learning Objectives

By the end of this sub-module, students should be able to:

- LO 8.5.1. Describe how to prepare solns with a desired concentration
- LO 8.5.2. Solve problems using molarity and the dilution equation
- LO 8.5.3. Calculate the concentrations of ions in soln

Prior Knowledge Review

- [Chem 1 Module 1.4 Mathematical Treatment of Measurements](#)
 - Description: Students should review module 1.4 on dimensional analysis in order to think of molarity as a conversion factor.
- [Chem I Module 8.1: Aqueous Solutions](#)
 - Description: Students should review the dissolution of ionic compounds in water in order to calculate the concentrations of ions in solution.

Instructional Materials

Textbook Sections

- OpenStax: Chemistry Atoms First 2e
 - [6.3 Molarity](#) (LO 8.5.1, 8.5.2)
- LibreText: Brown, LeMay, and Bursten
 - [4.5 Concentrations of Solns](#) (LO 8.5.1 - 8.5.3)

Videos Resources

- [Molarity](#) (LO 8.5.2, 8.5.3)
 - Description: This video clip (24:57-32:01) defines molarity and performs two calculations, one where the concentration of H_3PO_4 is determined from g of H_3PO_4 and volume of solution, and another where the concentrations of ions in an aqueous solution of $\text{Co}(\text{NO}_3)_2$ is determined. This clip helps students understand that the dissociation of a salt must be considered in order to determine the concentrations of ions in aqueous solutions.
 - License: By Eric Potma, Ph.D., [UCI OpenCourseWare General Chemistry 1P](#), licensed under CC BY-NC-SA
- [Preparing a soln w/ a desired molarity](#) (LO 8.5.1)
 - Description: In this video clip (32:02-38:26), students learn how to calculate the g of solute needed to prepare a solution with a desired molarity and volume. WARNING- The formula of the solute, Na_2SO_4 , on the slide is incorrect, but the instructor points out the mistake and corrects it verbally. Another example, using molarity to convert from mass of solute into volume of solution is also provided.
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- [Dilution](#) (LO 8.5.2)
 - Description: In this video clip (38:27-47:21), three dilution problems are worked. In the first example, water is added to an existing solution and students must recognize that moles of solute before dilution = moles of solute after dilution. In the other two examples, the problems are solved using the equation, $M_1V_1=M_2V_2$.

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Activities and Assessments

Study Guides / Worksheets

- [Solns. Molarity, Dilution](#) (LO 8.5.2-8.5.3)
 - Description: This reading guide can accompany section 6.3 in the OpenStax *Atoms First 2e* text.
 - Teaching Tip: Students may use this to take notes as they read the text or during a synchronous class meeting in a flipped format.
 - License: By Montgomery College, licensed under CC BY 4.0.
- [Solns Concentration Dilution](#) (LO 8.5.1-8.5.3)
 - Description: This worksheet addresses all the learning objectives in this module and asks students to recall the definitions of solute, solvent, homogeneous, and heterogeneous.
 - Teaching Tip: Use these as formative assessment, homework, or in-class (synchronous) problem-solving exercises.
 - Answer Key: [Solns Concentration Dilution Answer Key](#)
 - License: By Tria Skirko, licensed under a [Creative Commons Attribution 3.0 Unported License](#).
- [Molarity and Dilution](#) (LO 8.5.1-8.5.3)
 - Description: This worksheet addresses all the learning objectives in this module through quantitative problem-solving.
 - Teaching Tip: Use these as formative assessment, homework, or in-class (synchronous) problem-solving exercises.
 - License: By Washington State Colleges, Creative Commons Attribution 3.0 United States License.
- [Solns. Molarity, and Dilution](#) (LO 8.5.1-8.5.3)

- Description: This worksheet addresses all of the learning objectives in this module, but also asks three qualitative questions about electrolytes, requiring students to recall information from Module 8.1
- Teaching Tip: Use this worksheet as formative assessment, homework, or in-class (synchronous) problem-solving exercises.
- License: By Dr. Jordan Poler at the University of North Carolina Charlotte, licensed under a Creative Commons license 3.0.
- CY-ULUC: [Electrolytes and Molarity](#) (LO 8.5.1-8.5.3)
 - Description: This worksheet begins with a review of electrolytes, and continues with problems on molarity. Each question has several parts that guide students through the problem.
 - Teaching Tip: Use as formative assessment or in-class (synchronous) problem-solving exercise.
 - Answer Key: Worksheet [Answer Key](#)
 - License: By Dr. Christine Yerkes and the Department of Chemistry at the University of Illinois Urbana-Champaign ([Dr. Yerkes' website](#)) used with permission. Please attribute upon use.

Textbook Exercises

- OpenStax: Chemistry Atoms First 2e [6.3 Molarity](#) (LO 8.5.1, 8.5.2)
 - Description: End-of-chapter exercises, but the concentrations of ions (LO 8.5.3) is overlooked.
 - Teaching Tip: Use these as formative assessment, homework, or in-class (synchronous) problem-solving exercises.
- LibreText: Brown, LeMay, and Bursten [4.5 Concentration of Solns](#) (8.5.1, 8.5.2, 8.5.3)
 - Description: End-of-chapter exercises that address all LOs in this module.
 - Teaching Tip: Use these as formative assessment, homework, in-class (synchronous) problem-solving exercises, or as a test review.