

Molarity of Solutions

Part A:

To answer questions 1 – 4 you may need to complete some outside research using your notes, a scholarly website, a textbook or other source to answer these items.

In the boxes below, draw what you see if your solutions are saturated, unsaturated, and supersaturated.

Unsaturated

Saturated

Supersaturated

- 1) What are the different ways to measure concentration of a solution and why are they used for each situation?
- 2) Compare and contrast dilute and concentrated to unsaturated, saturated, and supersaturated. Use pictures if that is helpful for you.
- 3) What are the ways that enable you to increase the concentration of a solution?
- 4) What are the factors that allow you to increase the dissolving rate of a solution?

Access your computer. Open a browser and go to www.phet.colorado.edu. Go to the Molarity simulation under the Chemistry simulations. Click the “show values”.

In this simulation, we are assuming that the temperature is set constantly at 25 °C and that it remains constant. During this simulation, you are going to determine the number of grams for each sample of chemical. Use the following parameters: You have 0.50 L of substance (set the slider appropriately). You will choose two different number of moles (using the slider appropriately) to change the molarity of your solution. You cannot use drink mix because you cannot write the chemical formula for drink mix, unless you assume that it is sugar.

For each of the remaining solutions, solve for the number of grams of solute.

Substance	Moles (mol)	Volume (L)	Molarity (M)	Grams (g)
(A) Cobalt (II) nitrate				
(B) Cobalt (II) nitrate				
(C) Cobalt (II) chloride				
(D) Cobalt (II) chloride				
(E) Potassium dichromate				
(F) Potassium dichromate				
(G) Nickel (II) chloride				
(H) Nickel (II) chloride				
(I) Copper (II) sulfate				
(J) Copper (II) sulfate				
(K) Potassium permanganate				
(L) Potassium permanganate				

For each of the solutions above, show the calculations that demonstrate the number of grams needed to provide the saturated solution if you haven't achieved one already. If a solution is not possible to be saturated, state what you tried.

Part B:

Making solutions: Learn how to make solutions using proper lab equipment and techniques.

Your teacher will provide you with a volumetric flask, an electronic balance, and the assigned salt. Mass out the salt on the balance, add it to the volumetric flask, and add a small amount of de-ionized water. Then swirl the solution. Add enough water to the etched line to make the complete aliquot of solution.

Create a 0.25 M solution of a 500 mL of _____ (assigned by teacher).

Dilution Level	% Absorbance
(a) 0.15 M (teacher made 250 mL of this solution from the previous stock)	
(b) 0.10 M (teacher made 250 mL of this solution from the previous stock)	
(c) 0.075 M (teacher made 250 mL of this solution from the previous stock)	
(d) 0.05 M (teacher made 250 mL of this solution from the previous stock)	

- 5) Explain the procedure used that the teacher completed to make the serial dilutions. What equation was used? Show the math (full calculation for one of the dilutions above).
- 6) What errors could occur with the order of mixing solute to solvent?
- 7) When you make your dilutions what do you notice about the color of the solution?

Use a spectrophotometer, a GLX, a Wards Data Hub (using the turbidity function) or an app for phones like Image Color Picker.

- 8) Graph the curve created by the information presented by your device.
- 9) What is the relationship between concentration and absorbance? Develop a formula from your graph – plot the best fit line.
- 10) Determine what the absorbance of a 0.25 M solution would be using the equation that you developed.
- 11) Measure the absorbance of the 0.25 M solution using your equipment. Then calculate the percent error.

Part C:

- 12) How does the concentration of a rehydration solution affect how the body absorbs it? What does it do to the body if it is at a lower concentration or a higher concentration (remember biology)?
- 13) Where, in daily life, do you encounter substances that allow you to encounter a concentration? Name some of them and describe how they are important to your life.

Notes for Instructor:

For an on-level (college prep) course, you could use Part A alone (use your best judgment as to if you want to include parts B and C). For honors, include part B. For AP Chem, include Part C.