

## Concentration PhET Weblab Part 1 – Use HTML 5

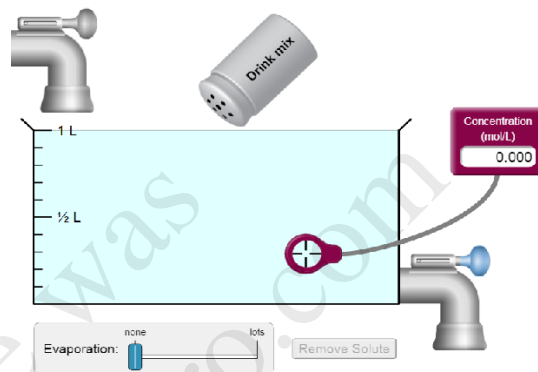
[https://phet.colorado.edu/sims/html/concentration/latest/concentration\\_en.html](https://phet.colorado.edu/sims/html/concentration/latest/concentration_en.html)



**Pre-Lab: These terms can all be found in the Unit 8 problem set #1. Complete #1 vocab matching. Check your answers (see instructor), make corrections, take a screen shot and include in this document.**

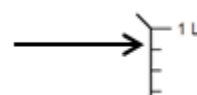
- |                    |                  |            |             |                     |
|--------------------|------------------|------------|-------------|---------------------|
| 1. Saturated       | 3. Solubility    | 5. Solute  | 7. Molarity | 9. Aqueous solution |
| 2. Solution (soln) | 4. Concentration | 6. Solvent | 8. Dilute   | 10. Insoluble       |

### Part 1: Concentration Calculations Using Molarity Formula - Procedure:

1. For Trial 1: Fill up the tank to 1 L, choose Solute: Drink Mix(solid), drag purple concentration meter into the tank as shown:
2. Shake the shaker to add solute to the water until you have an approx. concentration = 2 mol/L. Record the exact "Concentration of Soln" in Data Table 1.
3. Reduce the volume of water to approx. 0.50 L by draining half the tank. Without recording anything, notice any effect on the concentration and answer Part 1 - Questions # 1.



4. Click  to begin next trial.
5. For Trial 2(etc), Choose Cobalt (II) Nitrate (solid) & record its chemical formula and molar mass in Data Table 1. Fill your tank to the 9<sup>th</sup> mark as shown. Note the tank's volume is graduated by 0.1 L marks, so the volumes are written to the hundredths decimal place. Again, add solute until your concentration is approx. 2.0 mol/L and record the exact concentration in your table. If the solution reaches saturation before you are able to reach this concentration, write the word "SATURATED" in the concentration column and mark through the rest of that row on the Analysis Table – We will discuss saturation in Part 2. Click  to begin next trial
6. Repeat #5 for the other solid solutes, each time use 0.1 L less water (one mark down)



### Part 1-Analysis:

- Molarity =  $\frac{\text{moles of solute}}{\text{volume of solution in liters}}$
1. For the unsaturated trials only, use the molarity formula: to find the moles of solute added in each trial, fill in Analysis Table 1. Note – the unit for Molarity is mol/L, but is often called "Molar," abbreviated with a capital "M." Show work for Cobalt(II) Nitrate only below:

$$\begin{aligned} \text{moles solute} &= (\text{molarity})(\text{vol of solute}) \\ \text{moles solute} &= (2.000\text{m})(0.9\text{L}) = 1.8\text{mol} \end{aligned}$$

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2. For the unsaturated trials only, convert the mole of solute to grams for each trial and fill in Analysis Table 1. Recall: 1 mol = Molar Mass(g). Show work for Cobalt (II) Nitrate only below:

$$\text{molar mass} = 182.943 \text{ g/mol} \quad 182.8943 \text{ g/mol}$$

$$\text{g/m} = 182.943 \quad 182.8943 \text{ g}$$

$$\text{g} = 182.943 \times 1.804 \quad \frac{1}{1 \text{ mol}}$$

$$M = \frac{\text{moles of solute}}{\text{volume of solute}}$$

$$\text{Volume of Solute} \times \text{molarity}$$

$$0.9 \times 2.007$$

### Part 1-Data & Analysis

DATA TABLE 1					ANALYSIS TABLE 1	
Solute	Chemical Formula	Molar Mass (g/mol)	Volume of Water (L)	Concentration of Soln' (mol/L or M)	Moles of Solute (mol)	Grams of Solute (g)
Drink mix	UNKNOWN	UNKNOWN	1.00	2.009 mol/L	OMIT	UNKNOWN
Cobalt (II) nitrate	$\text{Co}(\text{NO}_3)_2$	182.943	0.90	2.007 mol/L	1.806	330.3
Cobalt chloride	$\text{CoCl}_2$	129.839	0.80	2.001 mol/L	1.6008	207.8
Potassium dichromate	$\text{K}_2\text{Cr}_2\text{O}_7$	294.185	0.70	.510 mol/L	Saturated	Saturated
Potassium chromate	$\text{K}_2\text{CrO}_4$	194.19	0.60	2.003 mol/L	1.2018	233.37
Nickel (II) chloride	$\text{NiCl}_2$	129.5994	0.50	2.005 mol/L	1.0025	129.923
Copper sulfate	$\text{CuSO}_4$	159.609	0.40	1.380 mol/L	Saturated	Saturated
Potassium permanganate	$\text{KMnO}_4$	158.034	0.30	.480 mol/L	Saturated	Saturated

### Part 1-Questions: Explain using complete sentences.

- Without adding any new solute, did draining some solution dilute the solution?  
Reducing the volume didn't alter the concentration.
- Which solute required the most mass to reach the 2 mol/L concentration? Least mass?  
 $\text{Cobalt II Nitrate} = \text{needs most mass}$   
 $\text{Nickel chloride} = \text{needs the least mass}$
- Which solutes saturated before reaching a concentration of 2 mol/L?  
 $\text{The } \text{K}_2\text{Cr}_2\text{O}_7, \text{CuSO}_4, \text{ and } \text{KMnO}_4 \text{ saturated below } 2 \text{ mol/L}$
- As you completed the trials, why should it take less & less mass to reach the concentration of 2.0 mol/L?  
There is less water and should saturate with less solute.