Name_____Date_____Period_____

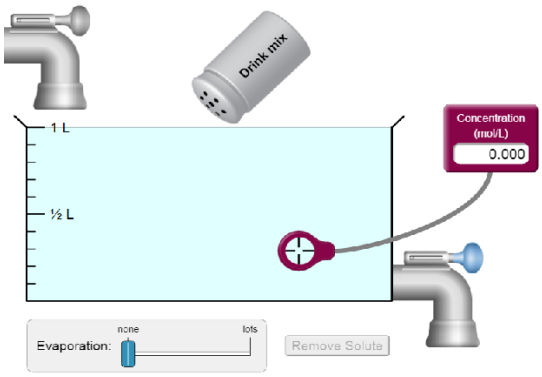
Concentration and Molarity PhET Weblab

https://phet.colorado.edu/sims/html/concentration/latest/concentration_en.html

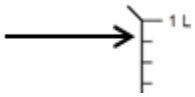
Pre-Lab: use your textbook or google to define the following terms on paper & attach

1. Saturated	3. Solubility	5. Solute	7. Molarity	9. Molar
2. Supersaturated	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 Question 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 9th 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:

1. For the unsaturated trials only, use the molarity formula: $\text{Molarity} = \frac{\text{moles of solute}}{\text{volume of solution in liters}}$ 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:

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:

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**		**OMIT**	**UNKNOWN**
Cobalt (II) nitrate			**0.90**			
Cobalt chloride			**0.80**			
Potassium dichromate			**0.70**			
Potassium chromate			**0.60**			
Nickel (II) chloride			**0.50**			
Copper sulfate			**0.40**			
Potassium permanganate			**0.30**			

Part 1-Questions: Explain using complete sentences.

1. Without adding any new solute, did draining some solution dilute the solution?

2. Which solute required the most mass to reach the 2 mol/L concentration? Least mass?

3. Which solutes saturated before reaching a concentration of 2 mol/L?

4. As you completed the trials, why should it take less & less mass to reach the concentration of 2.0 mol/L?

Part 2: Saturation - Procedure

1. Drain the tank. Choose the dropper solution for Cobalt (II) Nitrate  and fill the tank to 0.50 L (L). The solution is almost saturated. Add a little bit more solid solute with the shaker  until you reach the saturation for Cobalt (II) Nitrate. In Data Table 2, record the "Concentration at Saturation Point (mol/L or M)".
2. Shake in extra solute until you see the solid particles settling on the bottom and answer Question #1.
3. Click Remove Solute and repeat with each solute, skipping the Drink Mix using 0.50 L (1/2 L) every time.

Part 2-Analysis:

1. Calculate the moles of solute required to saturate the solution using the molarity formula and record your result in Analysis Table 2. Show work for Cobalt(II) Nitrate only below:
2. Calculate the grams of solute required to saturate the solution using the molar mass and record your results in Analysis Table 2. Show work for Cobalt (II) Nitrate below & Answer Question 2.

DATA TABLE 2		ANALYSIS TABLE 2	
Solute	**Concentration at Saturation Point (mol/L or M)**	**Moles required to saturate solution (mol)**	**Grams required to saturate solution (g)**
Cobalt (II) nitrate			
Cobalt chloride			
Potassium dichromate			
Potassium chromate			
Nickel (II) chloride			
Copper sulfate			
Potassium permanganate			

Part 2-Questions: Explain Using Complete Sentences

1. Once the solution saturated, the added solid solute does not dissociate. What does the excess do?

2. Using 0.50 L of solution each time, does the solubility of the solutes seem similar?

3. How could you "supersaturate" these solutions, exceeding the amount of dissolved solute possible for a given volume of solvent by preventing formula units from precipitating into crystals?

Part 3: Mass Percent & Graphing Mass Vs. Volume

Part 3-Procedure:

1. Click  . Begin by creating a saturated 0.10L solution of Cobalt (II) Nitrate by adding the solid until it stops dissolving. Record the minimum concentration to saturate this volume in Data Table 3.
2. Add more water to create a 0.20 L volume and add more solid to reach saturation. Record concentration. Continue up to a 1.00L volume.

Part 3-Analysis:

1. Calculate the moles of solute required to saturate the solution using the molarity formula and record your result in Analysis Table 3. Only show work for 0.10 L solution below:

2. Calculate the grams of solute required to saturate the solution using the molar mass and record your results in Analysis Table 3. Only show work for 0.10 L solution below:

3. On the Mass of Solute Vs. Volume of Solution graph, plot data points.

DATA TABLE 3		ANALYSIS TABLE 3	
Volume of Solution	**Concentration at Saturation Point (mol/L or M)**	**Moles required to saturate solution (mol)**	**Grams required to saturate solution (g)**
0.10			
0.20			
0.30			
0.40			
0.50			
0.60			
0.70			
0.80			
0.90			
1.00