**Names: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Molarity of Solutions Web Quest**

**Open a browser and go to** [**www.phet.colorado.edu**](http://www.phet.colorado.edu)**. Go to the “Concentration” simulation under the “Chemistry” simulations. Play with this simulation by adding salt, adding drops, adding water, removing water, and evaporating water; all along the way using the concentration meter. Then answer the questions below.**

1. What are the ways that enable you to increase the concentration of a solution?
2. What are the ways that enable you to decrease the concentration of a solution?

**Now go to the “Salts and Solubility” simulation under the “Chemistry” simulations. Play with this simulator by adding salt until a precipitate forms, adding and removing water to various solutions, all along noting the values in the top right corner. Then answer the questions below.**

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

Unsaturated

Saturated

Supersaturated

1. What is the most common way to measure concentration of a solution?
2. Compare and contrast dilute and concentrated versus unsaturated, saturated, and supersaturated. Use pictures if that is helpful for you.
3. What are the factors that allow you to increase the dissolving **rate** of a solution?

**Now 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 25oC. 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 the numbers 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.**

1. For each of the six solutions, record the moles you choose and the Molarity and then solve for the mass.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Substance | Moles (mol) | Volume (L) | Molarity (M) | Grams (g) |
| 1. Cobalt (II) nitrate |  | 0.50L |  |  |
| 1. Cobalt (II) chloride |  | 0.50L |  |  |
| 1. Potassium dichromate |  | 0.50L |  |  |
| 1. Nickel (II) chloride |  | 0.50L |  |  |
| 1. Copper (II) sulfate |  | 0.50L |  |  |
| 1. Potassium permanganate |  | 0.50L |  |  |

**Now go to the “Beers Law Lab” simulation under the “Chemistry simulations”. Click the “Beer’s Law” simulation. In this simulation, we are assuming that the temperature is set constantly at 25oC. During this simulation, you are going learn how a spectrophotometer works to determine concentration of a solution. Choose the Cobalt (II) Nitrate solution to start. Set the concentration to 0 mM (millimolar). The wavelength of the light on the left should be at a preset wavelength of 549nm and if you click the red button to turn it on the color will shine green through your solution.**

1. Record the transmittance and absorbance reported by the meter on the right.
2. Change the concentration of the Cobalt (II) Nitrate to 100mM. Record the transmittance and absorbance.
3. Using you previous answers, what do you think transmittance and absorbance means in this simulation?
4. Hypothesize what you think will happen to the transmittance and absorbance if you change the concentration to 200mmol. Then change the concentration and record the actual values. Did the transmittance increase, decrease, or remain the same? Did the absorbance increase, decrease, or remain the same?
5. Choose another salt from the drop down list. What happened to the wavelength and color of light coming from the device on the left?
6. At 0 mM are the values different than cobalt (II) nitrate?
7. At 100mM are the values different than cobalt (II) nitrate?
8. Play around with more salts and concentrations. What is the relationship between:
   1. Concentration and absorbance?
   2. Concentration and transmittance?
9. Use the ruler to determine the width of the container. This is called the path length of the light through the solution. Record that value.
10. The Beer’s Law formula is A=abc. Use your reference table to define each letter.
11. Choose copper sulfate at 100mM. Record the absorbance. Calculate the molar absorptivity (with units) of copper sulfate using the concentration and path length. (The A has no units.)
12. Verify Beer’s Law works by choosing a new concentration of copper sulfate and calculating the absorbance. Then check the absorbance on the meter.
13. What numbers are constant for a solution in Beer’s Law, A=abc?
14. Will those numbers be constant for a new solute?
15. In a lab, a student used the formula A1/A2 = c2/c1. Why can he use this as long as the solute stays the same? (Hint think about the previous two questions.)