Chemistry 11 Partners: _____

_____

Solutions and Molarity Simulation Lab

Every group of two will be responsible for handing in one lab.

Instructions: Every group needs to get a computer, log in, and open a browser.

Go to http://phet.colorado.edu/en/simulation/molarity and select open the simulation. Use the instructions below *(in italics)* and the simulation to answer the questions. **Terms and phrases in bold face are information which you are expected to learn and understand.**

Part 1: Basics of Solutions.

Select the Solute Menu (bottom middle). Select "Copper Sulphate" (which should actually be listed as Copper (II) sulphate). Select the "show values" box (bottom left).

Terms to Know

a.) **Solute- the chemical which is being dissolved**

b.) **Solvent- the chemical present in larger amounts that "dissolves" the solute. We will be assuming the solvent is water in all cases for this course unless otherwise stated. Therefore, all solute phases will be (aq).**

c.) **Solution- the combination/mixture of the solute and solvent**

d.) **Concentration- the measure of the amount of solute dissolved in a volume of solution. It can be measured in grams of solute per litre of solution ($\frac{g}{L}$) or, as it is more useful for chemistry, mole of solute per litre of solution ($\frac{mol}{L}$).**

1.) What kind of mixture is the solution? (heterogeneous or homogeneous)?

2.) What is the amount of solute dissolved? What is the volume of the solution?

3.) Calculate the concentration in $\frac{mol}{L}$. Does this agree with the listed value?

NOTE: Because chemists are lazy and writing $\frac{mol}{L}$ over and over again is boring and lots of work, we have abbreviated $\frac{mol}{L}$ to M, and we call the concentration the MOLARITY.

It is important to note that: **M = $\frac{mol}{L}$ = molarity**

4.) Calculate how many grams of copper (II) sulphate are dissolved in the solution (just like we have done throughout the mole concept unit).

5.) Calculate the concentration in $\frac{g}{L}$.

Select the "solution volume" slider and move it to $1.0\ L$.

6.) Did the concentration of the solution increase or decrease?
Did the amount of dissolved solute change?
What happened to the colour of the solution?

Explain why the concentration of the solution changed to its new value, using calculations to support your explanation.

When extra solvent is added but no extra solute is added, the solution has been DILUTED (you have performed a DILUTION).

When a solution is diluted, the concentration of the solution _____
(increases/ decreases)

Handy "rule of thumb":

If you double the volume of the solution without adding any solute, the new concentration will be _____ of the original concentration.

7.) In order to get back to the original concentration (before dilution), what are **two** different changes you could make to the diluted solution? Use the simulation to confirm it would work.

Increasing the concentration of a solution is known as CONCENTRATING a solution, and it can be accomplished by either:

a.) _____

Or b.) _____

Select the reset button and "copper sulphate" and "show values".

Slowly *increase the moles of solute until the concentrations stops changing.*

8.) What is the maximum concentration of the solution in M? Calculate what it is in $\frac{g}{L}$.

9.) Explain why the concentration of the solution stops increasing. What is this called (according to the words that show up in the beaker)?

10.) What happens when you continue to add solute past this point? Describe what you see in the beaker.

11.) What happens/ what do you observe if you remove solvent volume from the solution? Does the maximum concentration of the solution change?

A solution that contains so much solute that it can no longer dissolve is called a SATURATED SOLUTION. You can tell that a solution is saturated because it contains undissolved solute in the container. The MAXIMUM CONCENTRATION of a (saturated) solution (in either molarity or $\frac{g}{L}$) is called the SOLUBILITY of that compound.

12.) In the Dead Sea, you can walk around in the shallow parts of the sea and find golf ball sized chunks of NaCl under the water surface. Do some research (Hello Wikipedia or other site!!) and explain why/how this situation came to be. Make sure you use the term "saturated solution" in your explanation.

Part 2: Various Solutes and their Solubilities

Select "reset all" and "show values". Use the solute menu to change the solute and the controls to manipulate the solution to saturated to answer the following questions.

Solute	**Solute Chemical Formula**	**Solubility (M)**	**Molar Mass of solute ($\frac{g}{mol}$)**	**Solubility ($\frac{g}{L}$) (show calculation)**
Cobalt (II) chloride				
Potassium dichromate				
Gold (III) chloride				
Potassium permanganate				
Potassium chromate				

1.) Rank the 5 chemicals from the table from most soluble to least soluble according to molar solubility.