UNT Lesson Plan

Teacher:		**Date(s):**		**District:**		**School:**	
Subject area:	Chemistry	**Grade Level:**	10	**Unit Title**	Creek water analysis	**Lesson Title:** Solutions, Concentrations and Molarity	

Purpose and Lesson

Standard(s):	**Understanding goals(s):**	**Driving Question:**
TEKS: 112.C (2) Scientific processes. The student uses scientific methods to solve investigative questions. The student is expected to: (G) express and manipulate chemical quantities using scientific conventions and mathematical procedures, including dimensional analysis, scientific notation, and significant figures; (10) Science concepts. The student understands and can apply the factors that influence the behavior of solutions. The student is expected to: (A) describe the unique role of water	Students should develop an understanding of the following key terms: • Solute • Solvent • Dissolve • Solution • Molarity • Concentration • Ion	Is there a correlation between GPS location and the amount of certain ions in the creek water? How could out-of-range levels of these substances affect life in and around the creek?

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in chemical and biological systems; (B) develop and use general rules regarding solubility through investigations with aqueous solutions; (C) calculate the concentration of solutions in units of molarity; (D) use molarity to calculate the dilutions of solutions;		

Student Objectives:	**Assessment of Objectives:**	**Lesson Steps/Activities including Timeline & Grouping**
SWBAT calculate molarity when given concentration vice versa.	Assessed in class with worksheet and afterward with homework.	**Engage:** Remind students about field trip and work out any last-minute logistics. Tell the students that this lesson will help them to analyze the data that they will collect on the field trip. Introduce the discussion forum they will be using to answer questions throughout the week. 3 questions will be posted that night in which the students need to answer each in 75-100 words. Show Video about LISDOLA **Explore/Explain:** Start with the polyatomic molecules the students will be looking for in their samples (Nitrates, Phosphates, Chlorine, Ammonia). From this point, instructors will explain ions and the properties of their compositions. **POLYATOMIC IONS**

		Atoms in the same column as each other group tend to exhibit similar characteristics, including the number of electrons the elements would need to gain or lose to resemble the nearest noble gas atom. Group I ions (alkali metals) have +1 charges. • Group 2 ions (alkaline earth metals) have +2 charges. • Group 6 ions (nonmetals) have -2 charges. • Group 7 ions (halides) have -1 charges. • There is no simple way to predict the charges of the transition metals. Look on a table listing charges (valences) for possible values. For introductory and general chemistry courses, the +1, +2, and +3 charges are most often used. Barium has a +2 charge and hydroxide has a -1 charge, therefore 1 Ba^{2+} ion is required to balance 2 OH^- ions 1. Ammonium has a +1 charge and phosphate has a -3 charge, therefore 3 NH_4^+ ions are required to balance 1 PO_4^{3-} ion 2. Potassium has a +1 charge and sulfate has a -2 charge, therefore 2 K^+ ions are required to balance 1 SO_4^{2-} ion **Answer** 1. $Ba(OH)_2$ 2. $(NH_4)_3PO_4$ 3. K_2SO_4 **SOLUTIONS** Next we discuss solutions [solute, solvent, solubility rules] which shifts over to

concentration. Instructors will briefly introduce mathematical expressions of concentration including percent composition, volume percent, and the main expression **Molarity**.

Molarity

The molarity of a solution is calculated by taking the moles of solute and dividing by the liters of solution.

$$\frac{\text{Moles of solute}}{\text{Liters of solution}}$$

This is probably easiest to explain with examples:
Suppose we had 1.00 mole of sucrose (it's about 342.3 grams) and proceeded to mix it into some water. It would dissolve and make sugar water. We keep adding water, dissolving and stirring until all the solid was gone. We then made sure that when everything was well-mixed, there was exactly 1.00 liter of solution.
What would be the molarity of this solution?
The answer is 1.00 mol/L. Notice that both the units of mol and L remain. Neither cancels.
A replacement for mol/L is often used. It is a capital M. So if you write 1.00 M for the answer, then that is correct.
And never forget this: replace the M with mol/L when you do calculations. The M is just shorthand for mol/L.

Example 1. A 250 ml solution is made with 0.50 moles of NaCl. What is the Molarity of the solution?

		Solution: In this case we are given ml, while the formula calls for L. We must change the ml to Liters as shown below: 250 ~~ml~~ 1 liter x -------- = 0.25 liters 1000 ~~ml~~ Example 2. What would be the volume of a 2.00 M solution made with 6.00 moles of LiF? Solution: $\text{Liters of solution} = \frac{\text{\# of moles of solute}}{\text{Molarity}}$ Given: # of moles of solute = 6.00 moles Molarity = 2.00 M (moles/L) $\text{Liters of solution} = \frac{6.00\ \text{~~moles~~}}{2.00\ \text{~~moles~~/L}}$ **Answer = 3.00 L of solution** Example 2. What is the volume of 3.0 M solution of NaCl made with 526g of solute?

		Solution: First find the molar mass of NaCl. Na = 23.0 g x 1 ion per formula unit = 23.0 g Cl = 35.5 g x 1 ion per formula unit = 35.5 g ---------- **58.5 g** Now find out how many moles of NaCl you have: $\# \text{ of moles} = \frac{\text{mass of sample}}{\text{Molar mass}}$ Given: mass of sample = 526 g Molar mass = 58.5 g $\# \text{ of moles of NaCl} = \frac{526\ g}{58.5\ g}$ Answer: # of moles of NaCl = **8.99 moles** Example 3. How many grams of $CaCl_2$ would be used in the making of 5.00 x 10^2 cm^3 of a 5.0M solution? In this case, what they are looking for is different. You could start to solve this problem the same way you did example 1, but the end would

require you to change the number of moles of $CaCl_2$ to the mass of $CaCl_2$. You would use the formula below.

$$\#\text{ of moles} = \frac{\text{mass of sample}}{\text{Molar mass}}$$

$$\#\text{ of moles} \times \text{Molar mass} = \frac{\text{mass of sample}}{\text{Molar mass}} \times \cancel{\text{Molar mass}}$$

mass of sample = # moles of solute x Molar mass

Given: # of moles of solute = 2.5 moles (from our answer to example 1.)
Molar mass of solute ($CaCl_2$) = 111 g/mole (from the periodic table)

Mass of $CaCl_2$ = 2.5 ~~moles~~ x 111 g/~~mole~~

Answer: Mass of $CaCl_2$ = 280 g (when rounded correctly)

Elaborate (10 min, grouping):
Any relevant questions or concerns which arise from the explain portion and/or this section of the project will be addressed.
Crystal Light: Fruit Punch Juice

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		Give each group a water bottle with different amounts and an individual pack of Fruit Punch Crystal Light. 1. How are the different concentrations going to affect molarity? 2. Figure out the molarity for your sample? **Evaluate:** • Quiz Molarity and Polyatomic Ions • Students will finish homework worksheet and complete discussion forum questions, due before midnight. • Discussion Forum Questions: Respond with 75-100 words Given Monday, Due Tuesday: 1. Research each chemical. At what amounts are the chemicals most harmful and what are their effects? 2. At what amounts are the chemicals beneficial? Describe their beneficial effects. 3. Where do these 4 chemicals derive?	
Language Modifications	**Special Needs Modifications**	**Materials & Resources:**	**Technology:**
ELL students may use the internet and	We are not yet aware of the modifications that	Worksheet	Calculators, projector or similar device for power point.

their group members as needed to translate the questions and interpret information gathered. We will also consider a word wall for if it is appropriate for the class.	we will need to make.		

Reflection		
What worked:	**Improvements:**	**Overall Implications for your teaching:**
What parts of the lesson led to engagement and student learning?	How can you increase student learning, engagement, etc., next time you teach this lesson?	What did you learn from teaching this lesson that can apply to other lessons?