High School Science Virtual Learning

College Chemistry Solutions Virtual Lab

May 6, 2020

High School College Chemistry
Lesson: May 6, 2020

Objective/Learning Target:
Students will complete lab activities to learn about solutions.

Let’s Get Started:

1. Give at least two properties of water.

2. What is the definition of solute and solvent?

Let's Get Started: Answer Key

1. Polar covalent molecule, has a high surface tension, liquid at room temperature, freezes at 0^0C and boils at 100^0C, and when solid has a larger volume then when in its liquid form.

2. Solute = substance that is dissolved into the solvent
   Solvent = substance that does the dissolving

Lesson Activity:

- Just like the lessons from earlier this week, this activity will be split between two days.
- Today you will watch the lab video and complete the lab worksheet. There are some review concepts, so there are some additional notes added after the lab.
- Tomorrow you will check your answers and watch a deeper explanation of the lab.

Lesson Activity:

Directions

- Watch this video.
- Answer the questions on your lab worksheet.
- The data for the lab worksheet can be found here.

NOTES:

- What is a solution?
  - in chemistry, a solution is any compound/substance dissolved in water
- Why is water so important?
  - it is considered a universal solvent, because it can dissolve several compounds (ionic and polar covalent)

NOTES:

Types of Mixtures

- Homogeneous Solution is a solid, liquid, or gaseous mixture that has the same proportions of its components throughout any given sample. Considered to have one phase that can be seen.
  - Example - salt water
- Heterogeneous Solution has components in which proportions vary throughout the sample. Considered to have two or more phases that can be seen.
  - Example - sand and water

NOTES:

- Properties of Water:
  - Capable of hydrogen bonding causing it to have strong surface tension
  - Liquid at room temperature
  - Use this video to help you understand water: Amoeba Sisters
- “Like Dissolves Like”
  - Common phrase used to determine what can or cannot dissolve in any substance.
  - Since water is a polar molecule - only substances that are also polar like salt and sugar can dissolve in it.
  - The reverse is also the same - oil which is not polar cannot mix with water.

NOTES:

Measuring Solutions

- Concentration - way of describing amount of solute to solvent.
- Molarity - number of moles of solute dissolved in one liter of solution.

$$\text{Molarity } (M) = \frac{\text{moles of solute}}{\text{liters of solution}}$$

- Diluting a solution reduces the number of moles of solute per unit volume, but the total number of moles of solute in solution does not change.

$$\text{Moles of solute} = M_1 \times V_1 = M_2 \times V_2$$

Practice

Complete the following questions using the information you learned during the lesson activity.

Questions:

1. 1.0 moles of potassium fluoride is dissolved to make 0.10 L of solution.
2. 1.0 g of potassium fluoride is dissolved to make 0.10 L of solution.
3. 1.0 g of potassium fluoride is dissolved to make 0.10 mL of solution.
4. 952 g of ammonium carbonate are dissolved to make 1750 mL of solution.
5. 9.82 g of lead (IV) nitrate are dissolved to make 465 mL of solution.

Answer Key:

1. $\frac{1.0 \text{ mole KF}}{0.10 \text{ L soln}} = 10. \text{ M}$

2. $1.0 \text{ g KF} \times \frac{1 \text{ mole KF}}{58 \text{ g KF}} = 0.0172 \text{ mol KF}$

   $\frac{0.0172 \text{ mol KF}}{0.10 \text{ L soln}} = 0.17 \text{ M}$

3. $1.0 \text{ g KF} \times \frac{1 \text{ mole KF}}{58 \text{ g KF}} = 0.0172 \text{ mol KF}$

   $\frac{0.0172 \text{ mol KF}}{1 \times 10^{-4} \text{ L soln}} = 170 \text{ M}$

4. $952 \text{ g } (NH_4)_2CO_3 \times \frac{1 \text{ mole } (NH_4)_2CO_3}{96 \text{ g } (NH_4)_2CO_3} = 9.92 \text{ mole } (NH_4)_2CO_3$

   $\frac{9.92 \text{ mole } (NH_4)_2CO_3}{1.75 \text{ L soln}} = 5.67 \text{ M}$

5. $9.82 \text{ g } Pb(NO_3)_4 \times \frac{1 \text{ mole } Pb(NO_3)_4}{455.2 \text{ g } Pb(NO_3)_4} = 0.0216 \text{ moles } Pb(NO_3)_4$

   $\frac{0.0216 \text{ moles } Pb(NO_3)_4}{0.0465 \text{ L soln}} = 0.0465 \text{ M}$