Molarity Intro Worksheet (WS 18.00?) Key Name:_____ p.____

1. Briefly define these terms:

Solution: A homogeneous mixture; two or more elements and/or compounds that are well mixed (uniform throughout), but not chemically bonded to e/o.

Solute: The substance that dissolves. *

Solvent: The substance that the solute dissolves into. *

* If a solid or gas dissolves into a liquid, the solid or gas is the solute, and the liquid is the solvent.
If all substances are the same phase (for example, two gases or two liquids) the solute is the substance(s) present in smaller amt, the solvent is present in greater amount.

2. Identify the solute and the solvent in each of these:

	solute	solvent
a. 10 grams of sugar dissolved into 100 mL of water	sugar	water
b. a mixture created by mixing 50 mL ethyl alcohol with 20 mL of water	water	ethyl alcohol
c. $CaCl_{2(aq)}$	$CaCl_2$	water
d. 10 mL vegetable oil dissolved into 80 mL of liquid hexane	vegetable oil	hexane
e. Sweat	salt (etc)	water
f. 100 grams of sugar dissolved into 50 grams of water.	sugar	water

3. Molarity = $\frac{\text{moles solute}}{\text{Liters solution}}$

4. If 2.8 moles of sodium carbonate are dissolved into water, so that the total solution volume is 480 mL, calculate the molarity of Na_2CO_3 in this solution.

$$\text{molarity} = \frac{\text{moles } Na_2CO_3}{\text{L solution}} = \frac{2.8 \text{ moles}}{0.48 \text{ L}} = 5.833 \rightarrow 5.8 \text{ mol/L}$$

or 5.8 M

5. If 85.7 grams of sodium chloride are dissolved per 400.0 mL solution, what is the molarity of NaCl?

$$\frac{(85.7 \text{ g NaCl})\left(\frac{1 \text{ mole}}{58.4428 \text{ g}}\right)}{0.4000 \text{ L}} = \frac{1.46639 \text{ moles}}{0.4000 \text{ L}} = 3.67 \text{ M} \quad \text{or} \quad 3.67 \frac{\text{mole}}{\text{L}}$$

6. What is the molarity of a solution with a volume of 1250 mL, if it contains 150. grams of sodium carbonate?

$$\frac{(150. \text{ g } Na_2CO_3)\left(\frac{1 \text{ mole}}{105.9889 \text{ g}}\right)}{1.25 \text{ L}} = \frac{1.4152 \text{ mole}}{1.25 \text{ L}} = 1.13 \text{ M}$$

7. A solution contains 50.0 grams of magnesium chloride per 400. mL of solution. Find the concentration (molarity) of magnesium chloride in this solution.

$$\frac{(50.0 \text{ g } MgCl_2)\left(\frac{1 \text{ mole}}{95.211 \text{ g}}\right)}{0.400 \text{ L}} = 1.31 \text{ M}$$

18.00 Key

8. $Mg_{(s)} + 2\,HCl_{(aq)} \text{-----> } MgCl_{2(aq)} + H_{2(g)}$

A piece of magnesium with a mass of 10.504 grams is dropped into 251 mL of dilute hydrochloric acid, and the reaction is allowed to proceed until hydrogen bubbles are no longer forming. The piece of Mg is then dried and weighed, and found to have a mass of 10.002 grams. Use this information to find the molarity of the hydrochloric acid.

$10.504\,g - 10.002\,g = 0.502\,g\ Mg$ reacted

$(0.502\,g\ Mg)\left(\frac{1\,mole}{24.305\,g}\right)\left(\frac{2\,mole\ HCl}{1\,mole\ Mg}\right) = 0.041308\ moles\ HCl$

$\frac{0.041308}{0.251L} = 0.16458$

0.165 M

9. $2\,Al_{(s)} + 6\,HCl_{(aq)} \text{-----> } 2\,AlCl_{3(aq)} + 3\,H_{2(g)}$

A solution of 50.0 mL of hydrochloric acid is reacted with Aluminum: 1.24 grams of aluminum foil are placed into the HCl solution and left to react for several days in the acid. When the remaining piece of aluminum is dried and weighed, it is found to have a mass of 0.32 grams. Determine the molarity of the hydrochloric acid solution.

$1.24\,g - 0.32\,g = 0.92\,g\ Al$ reacted

$(0.92\,g\ Al)\left(\frac{1\,mole}{26.9815\,g}\right)\left(\frac{6\,mole\ HCl}{2\,mole\ Al}\right) = 0.10229\ moles\ HCl$ reacted

$\frac{0.10229\ mole\ HCl}{0.0500L} =$ **2.05 M HCl**

Chem Lab: Molar Concentration of HCl!

Purpose: In this lab, you will determine the molarity of a solution of hydrochloric acid. You will react a known volume of HCl solution with calcium carbonate chips, and use the initial and final masses of the calcium carbonate to calculate the moles of HCl that must have reacted, which will allow you to calculate the molarity of the acid.

Procedure: (wear goggles for steps 1-7!)

1. Make sure that your 100 mL beaker is clean and dry. Use a wax pencil to label it with your locker number.

2. Obtain the mass of the beaker; record.

3. Add 4-5 marble chips (calcium carbonate) to your beaker. Weigh the beaker and chips together; record.

4. Determine which lab "island" you are on, and measure the following amount of HCl solution in your grad cylinder.

East side island (near goggle cabinet) : use 45.0 mL acid.
Center island : use 40.0 mL
West side island (near stockroom) : use 35.0 mL

5. Record the volume of acid used in your data table.

6. Pour the acid into the beaker with the marble chips. Record qual data.

7. Rinse grad cylinder with tap water and put away. Put your beaker and contents in your lab locker til next time.

The next day:

8. Observe the contents of the beaker (record qual data).

9. Decant the clear solution from your beaker into the sink (Don't dump out the solid!)

10. Add distilled water to the chips in the beaker. Swirl and let the solid settle. Decant again. (Don't dump out the solid!)

11. Repeat step 10.

12. Make sure that you labeled your beaker. Take the beaker to the oven to dry. Your teacher will tell you which shelf to use.

(The next day after that...)

13. Weigh your beaker and remaining marble chips; record.

14. Dump the chips in the trash, rinse beaker with tap water, and put away beaker.