

## Bonus Problem Activities

Name \_\_\_\_\_

Date: \_\_\_\_\_

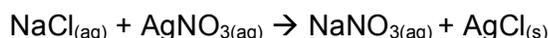
**Due:** Thursday, February 10, 2005, **IN CLASS****The assignment is equivalent to 2 extra homework assignments.**

*This activity uses the Virtual Lab, please go to <http://iry.chem.cmu.edu/chem/clark/> to access the problems below.*

*[Please follow the above link and click on **Problem 1** to access the virtual lab for the first set of problems]*

**Problem 1a:**

In this problem we'll consider the reaction



Note that all of the aqueous species in the above reaction exists as ions in solution:

NaCl<sub>(aq)</sub> exists as Na<sup>+</sup> and Cl<sup>-</sup>AgNO<sub>3</sub> exists as Ag<sup>+</sup> and NO<sub>3</sub><sup>-</sup>NaNO<sub>3</sub> exists as Na<sup>+</sup> and NO<sub>3</sub><sup>-</sup>

AgCl(s) is a white solid.

*(For these problems, please click on the Molarity tab of the solution info pane to display units in grams)*

Species	Molarity
H <sup>+</sup>	1.000e-1
OH <sup>-</sup>	
Cl <sup>-</sup>	1.000e-1

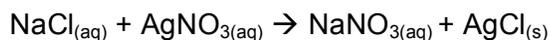
- 1) The solution labeled "1.00g NaCl" contains 1.00g of NaCl dissolved in water. Use the solution viewer to determine the number of grams of Na<sup>+</sup> and Cl<sup>-</sup> in the solution, and confirm that these add to 1.00g.
- 2) The solution labeled "1.00g AgNO<sub>3</sub>" contains 1.00g of solid AgNO<sub>3</sub>. Add 100ml of water to this solution. Use the solution viewer to determine the number of grams of Ag<sup>+</sup> and NO<sub>3</sub><sup>-</sup> in the solution.
- 3) Now pour the contents of the "1.00g AgNO<sub>3</sub>" solution that you made in step 2 into the 1.00g solution of NaCl. Write down the mass of each species in solution and the mass of solid AgCl formed. *[Note you will have to click the "solid" button on the solution information panel to view the solids in your solution]* Confirm that the amounts of these species are consistent with what you say in parts (2) and (3).

Mass Ag <sup>+</sup>		Mass NO <sub>3</sub> <sup>-</sup>	
Mass Na <sup>+</sup>		Mass Cl <sup>-</sup>	
Mass AgCl (s)			

**Problem 1b:**

The solution labeled "Solution 1" in the virtual lab stockroom contains 2.00 grams of Sodium Chloride.

i) How many grams of Silver Nitrate must be added to the solution to completely react with Sodium Chloride according to the reaction below? How many grams of silver chloride will be formed? Show your calculations below.



Note that all of the aqueous species in the above reaction exists as ions in solution:

$\text{NaCl}_{(aq)}$  exists as  $\text{Na}^+$  and  $\text{Cl}^-$

$\text{AgNO}_3$  exists as  $\text{Ag}^+$  and  $\text{NO}_3^-$

$\text{NaNO}_3$  exists as  $\text{Na}^+$  and  $\text{NO}_3^-$

$\text{AgCl}_{(s)}$  is a white solid.

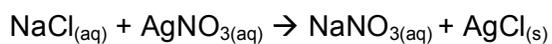
Mass $\text{AgNO}_3$	
Mass $\text{AgCl}$	

ii) Use the virtual lab to add that amount of Silver Nitrate to the solution. Check to make sure the reaction was complete, by making sure the amount of  $\text{Ag}^+$  and  $\text{Cl}^-$  in the solution are both less than 0.01g. How much  $\text{AgCl}$  is formed?

Mass $\text{AgCl}$	
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**Problem 1c:**

The solution labeled "Solution 2" in the virtual lab stockroom contains 3.00 grams of  $\text{AgNO}_3$ . When  $\text{NaCl}$  is added to the solution, the following reaction occurs:



i) If excess  $\text{NaCl}$  is added to the solution, how many grams of  $\text{AgCl}_{(s)}$  will be formed? Show your calculations.

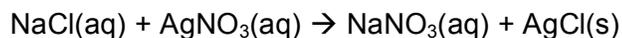
Mass $\text{AgCl}$	
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ii) Use the virtual lab to check your answer to part (a). Explain the laboratory procedure you used to perform this check.

[The following set can be accessed by clicking on: **Problem2**]

**Problem 2:**

The solution labeled "Solution 3" in the virtual lab stockroom contains an unknown amount of AgNO<sub>3</sub>. When NaCl is added to the solution, the following reaction occurs:



a) Design and perform an experiment to determine the mass of Ag NO<sub>3</sub> that was present in the solution.

***Check your answer by entering the mass into the form at the bottom of the problem 2 webpage. Please print the checked answer, and include it with your assignment.***

b) Please describe your complete procedure for determining the mass of the Ag NO<sub>3</sub> that was present in the solution including any quantities you measured.

[The following set can be accessed by clicking on: **Problem3**]

**Problem 3:**

You are given four substances A, B, C, and D that are known to react in some weird and mysterious way (a wizard relayed this information to you), design and perform virtual lab experiments to determine the reaction between these substances, including their stoichiometric coefficients. You will find 1.00M solutions of each of these chemical reagents in the stockroom.

***Once you're done check your answers in the form below the lab. Please print the checked answer, and include it with your assignment***

Please describe your complete procedure and the key quantities you measure. Points are based on whether or not you explain your procedure in sufficient detail for us to know what you did. You are not graded on the method you used: all approaches that meet the goal are fine.