Solution Concentrations and Stoichiometry

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1. Answer the following questions relative to the dissolving of a substance in a solvent.
   a. Write out the dissolving equation for NaCl.

   $NaCl \rightarrow Na^+ + Cl^-$

   b. If a solution has a concentration of 0.5M NaCl, what are the concentrations of

   $[Na^+]$ = 0.5M

   $[Cl^{-1}]$ = 0.5M

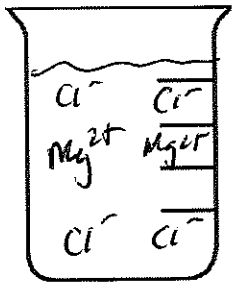
2. Identify the concentrations of each ion in a 0.75M $MgCl_2$ solution.
   a. Write out the dissolving reaction

   $MgCl_2 \rightarrow Mg^{2+} + 2Cl^-$

   b. Draw a representative solution in the beaker to the right.

   c. $[Mg^{2+}]$ = 0.75M x1

   $[Cl^{-1}]$ = 1.5M x2



3. For each of the following solutions determine the concentration of each ion.
   a. 0.75M $AlCl_3$ Al^{+3} 0.75 Cl^- = 2.25

   b. 0.25M $Mg_3(PO_4)_2$ .25x2 = 0.5M

   3x.25 = 0.75M

4. In the beaker to the right is a beaker representing a 50mL 0.1M $MgCl_2$ solution, draw a representative solution that is 50mL 0.2M in the beaker to the right.

   $MgCl_2$

   a. What is the $[Cl^{-1}]$ ions in the 0.1M beaker?

   .1M x2 = 0.2M

   b. What is the $[Cl^{-1}]$ ions in the 0.2M Beaker?

   .2x2 = 0.4M

   c. Calculate the moles of Cl^- in the 0.1M beaker?

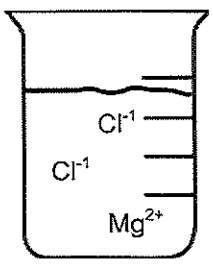
   $.1 = \frac{x}{.05}$ = x = .005mol

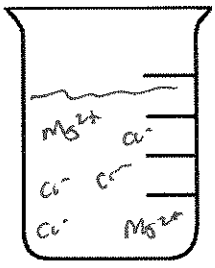
   d. With out calculating, how many moles of Cl^{-1} are in the second beaker?

   .5x2 = .01mol

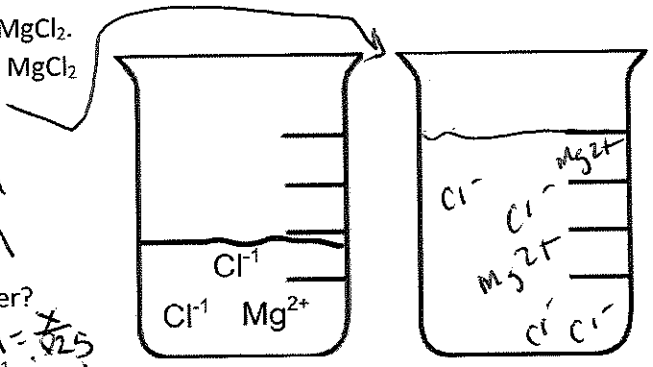
   e. If you were to triple the concentration of a solution the number of moles in the solution will _____.

   original .015mol



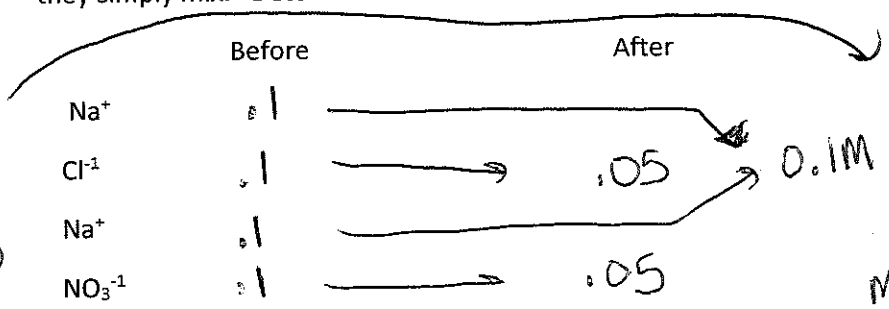


5. In the beaker to the left is a 25mL 0.1M solution of $MgCl_2$.
   a. In the beaker to the right draw a 50ml 0.1M $MgCl_2$ solution.
   b. What is the $[Cl^{-1}]$ ions in the 25mL beaker? 0.2M
   c. What is the $[Cl^{-1}]$ ions in the 50mL Beaker? 0.2M
   d. Calculate the moles of Cl^- in the 25mL beaker? $x = .0025$ mol $0.1 = \frac{x}{.025}$
   e. Without calculating, how many moles of Cl^{-1} are in the 50mL beaker? .005 mol ×2
   f. Tripling the volume of a solution will Triple the number of moles in the solution. $.0025 \times 3 = 0.0075$



6. Beaker A is a 25mL 0.1M solution of $MgCl_2$ Beaker B is a 50mL 0.2M solution of $MgCl_2$. Compare the moles present in each solution respectively
   Beaker A: Mg^{2+}= .0025 moles In beaker B the $[Mg^{2+}]$ is 4 time more concentrated. Beaker B has a Mg^{2+} = .01 moles. In beaker A, the Cl^{-1} ion is 2x the concentration of Mg^{2+} ion of beaker A. In beaker A the moles of Cl^{-1} = .005. In beaker B the Cl^{-1} is 4 times more concentrated then in beaker A. The moles of Cl^{-1} ion in beaker B = 0.04 moles
   $.1 = \frac{x}{.025}$ $x = .0025$ mol
   A: $Mg^{2+} = 0.0025$ mol Cl^-: 0.005 mol B: $Mg^{2+} = 0.01$ mol Cl^-: 0.04 mol

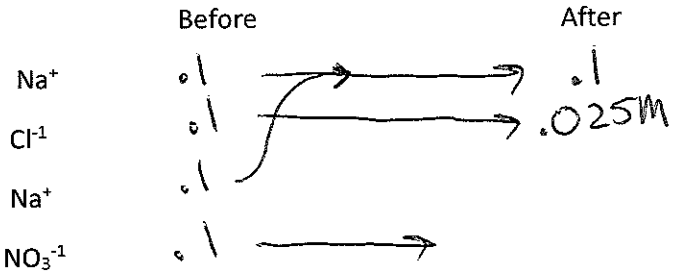
7. A 10ml 0.1M solution of NaCl is mixed with a 0.1M 10mL solution of $NaNO_3$. No reaction occurs, they simply mix. Determine the concentration of each ion before and after mixing.



Mixing 0.1 with 0.1 equals 0.1M Think (:)

$M = \frac{mol}{L}$
$.1 = \frac{x}{.01}$ $x = .001$
$.1 = \frac{x}{.01} = \frac{.001}{.002}$
$M = \frac{mol}{L}$ $\frac{.002}{.02} \leftarrow 20mL \Rightarrow 0.1M$

8. A 10ml 0.1M solution of NaCl is mixed with a **0.1M 30mL** solution of $NaNO_3$. No reaction occurs, they simply mix. Determine the concentration of each ion before and after mixing.



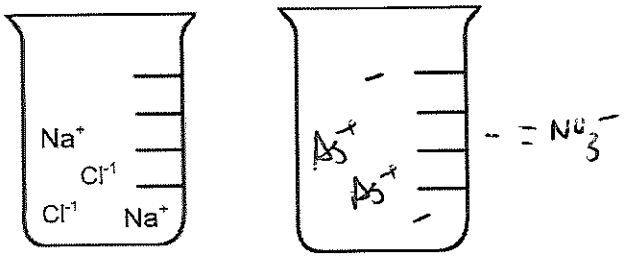
$M_1V_1 = M_2V_2$ $= 0.025$
$.1 \ 10 = x \ 40$
$.1 \cdot 30 = x \ 40$
$x = 0.075M$

9. A 10mL 0.1M solution of NaCl is reacting with a 0.1M solution of $AgNO_3$.

a. Write out the reaction.

$NaCl + AgNO_3 \rightarrow AgCl(s) + NaNO_3$

b. The NaCl solution is in the beaker to the left, In the beaker to the right draw the minimum amount of $AgNO_3$ needed to remove all the Cl^- ions.



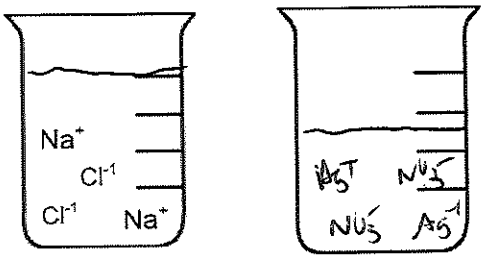
c. What is the volume of $AgNO_3$ solution?

10mL

10. A 20mL mL 0.1M solution of NaCl is reacting with a 10mL 0.2 M solution of $AgNO_3$.

$Ag^+ + Cl^{-1} \rightarrow AgCl(s)$

a. Draw the beaker to the right.



b. What is the Mass of AgCl produced?

½ Vol, But equal moles

c. Determine the concentration of each ion before and after they were mixed.

	Before	After
Na^{+1}	.1	
Cl^{-1}	.1	→ 0
Ag^+	.2	→ 0
NO_3^{-1}	.2	

d. $M_1V_1 = M_2V_2$

$.1 \cdot 20 = X \cdot 30$ $X =$

11. A 10mL 0.1M solution of $MgCl_2$ is reacting with a 10ml 0.1M solution of $AgNO_3$.

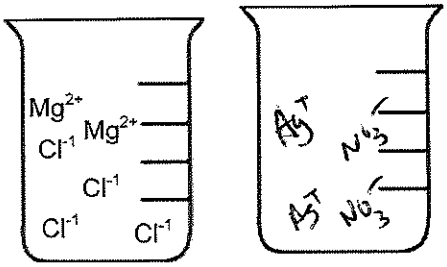
a. Write out the net ionic reaction and complete an ISE table.

$.1 = \frac{x}{.01}$

$x = .001$

$x2 = .002$

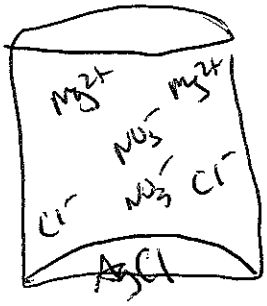
	$Cl^- + Ag^+ \rightarrow AgCl$		
I	0.002	.001	0
S	-.001	-.001	+.001
E	+.001	0	.001



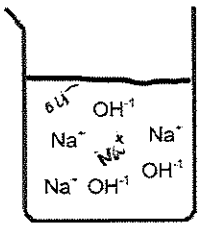
b. Determine the concentration of each ion before and after they were mixed.

	Before	After
Mg^{2+}	.1	→ .05
Cl^{-1}	.2	→ .1 → .05
Ag^+	.1	→ 0
NO_3^{-1}	.1	→ .05

$.061/.02 = .05$ equal



20.0 mL of 0.200 M $NaOH_{(aq)}$ is added to 20.0mL of 0.100M $HCl_{(aq)}$. Answer the following questions from the information provided.



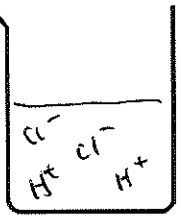
12. $NaOH\ (aq) + HCl \rightarrow NaCl(aq) + H_2O$
To a beaker, 50mL of 0.2M NaOH is added to 25 mL of 0.2M HCl.

a. Complete the ISE table below for the net ionic reaction.

	OH^{-1}	+ H^+	→	$H_2O(l)$
I.	.01	.005		
S.	-.005	-.005		+.005
E	.005	0		

$.2 = \frac{x}{.05}$ $x = .01$

$.2 = \frac{x}{.025}$ $x =$



b. Using your LR determine, how much water is produced?

$.005 \cdot \frac{18}{1} = 0.09g$

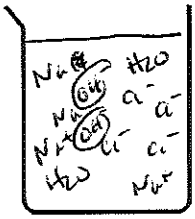
c. Determine the following concentrations:

	H^+	Cl^{-1}	Na^+	OH^-
Before:	.2	.2	.2	.2
After:	0	.067	.13	.066M

$M_1V_1 = M_2V_2$

spectators Na $.2 \cdot .50 = x \cdot .75$ $x = .13$

Cl $.2 \cdot .25 = x \cdot .75$ $x = .067$



$\frac{.005}{.075}$ $.066$

d. Draw a picture of the before beakers (left) and final beaker (right). Show particle proportionality.

13. To a beaker, 50mL of 0.2M AgF is added to 25 mL of 0.2M KOH.

e. Complete the ISE table below. (do this in moles)

	Ag^+	+ OH^{-1} →	$AgOH_{(s)}$
I.	.01	.005	—
S.	-.005	-.005	+.005
E	0.005	0	0.005

$.2 = \frac{x}{.05L}$ $x = 0.01$

$.2 = \frac{x}{.025}$ $x = .005$

f. Using your LR determine, how much water is produced?

$.005\,mol \cdot \frac{18}{1\,mol} = 0.09g$

g. Determine the following concentrations:

	Ag^+	F^{-1}	K^+	OH^-
Before:	.2	.2	.2	.2
After:	.066	0.133	0.066	0

Spectators

$M_1V_1 = M_2V_2$

$.2 \cdot .50 = x \cdot .75$ $x = 0.133M$

$.2 \cdot .25 = x \cdot .75$ $x = 0.066M$

$\frac{1}{2}$ precipitated

$\frac{.005mol}{.075} = 0.066 \rightarrow .066$

New vol

h. Draw a picture of the before beakers (left) and final beaker (right). Show particle proportionality.