Student Practice

(#7-2d)
Chemistry
Stoichiometry and concentrations

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1. To a beaker, 20.0 ml of 0.100 M $AgNO_3$ has an aqueous solution of 0.05M NaCl, added causing a solid to precipitate.

   a. Write the complete balanced equation. $AgNO_3 + NaCl \rightarrow AgCl_{(s)} + NaNO_3$

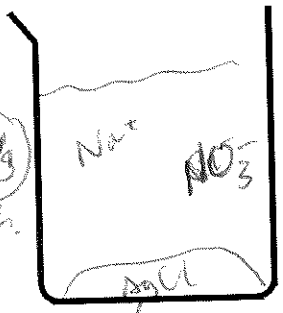
   b. How many moles of $AgNO_3$ are present before the reaction?
   M·L = mol .1 × .02 = .002 mol

   c. What is the solid precipitating?
   use $AgNO_3$ as L.R. .002 | 1 AgCl | 142 = 0.284g | 1 | 1 mol

   d. How many mL of NaCl will be needed to reach equivalence?
   NaCl is ½ as conc. so, we need twice as much. 40ml

   e. What is the concentration of each ion in solution at equivalence?
   L.R: Ag^+ + Cl^- ion ← they match / Ag^+: .1/0 Cl^-: .05/0 NO_3^-: .1/.033M Na^+: .05/.033M

   f. Draw a picture of the beaker at equivalence. Show particle proportionality.
   $Na^+ = NO_3^-$ AgCl is solid. Same moles



$M_1V_1 = M_2V_2$; $\frac{M_1V_1}{V_2} = M_2$; $\frac{.1 \cdot 20}{60} = .033M$; $\frac{.05}{60} = .033M$ dilution

Spectators: NO_3^- Na^+

2. 20.0 mL of 0.200 M $NaOH_{(aq)}$ is added to 10.0mL of 0.200M $HCl_{(aq)}$. Answer the following questions from the information provided.

   a. Using proportions, which item is the limiting reactant? HCl

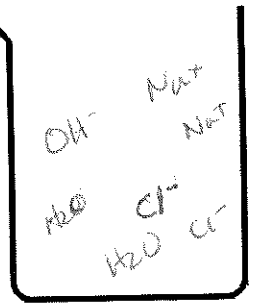
   b. Write the complete balanced equation and create an ISE table below
   $NaOH(aq) + HCl \rightarrow NaCl(aq) + H_2O$

	$NaOH$	HCl	$NaCl$
I	.004	.002	
S	−.002	−.002	+.002
E	.002	.0	.002

   c. ~~What is the concentration of each ion before any neutralization?~~
   spectators, just getting diluted

   d. What is the concentration of each ion in the solution after mixed?
   spectators: Na^+: .2/.133 Cl^- .2/.006 L.R: H^+ .2/0 excess: $\frac{.002}{.03L}$ (dilute) OH^-: .2/.06M

   e. Draw a picture of the final beaker. Show particle proportionality.
   do your best on proportions.



   f. How many more mL would be needed to get the reaction to equivalence? (Equivalence means equal moles)
   10 ml

$M = \frac{mol}{L}$

$\frac{M_1V_1}{V_2} = M_2$ Na^+ ; $\frac{20 \cdot .2}{30} = 0.133$ Cl^- ; $\frac{10 \cdot .2}{30} = .066$

M·L = mol
(.2)(.05) = .01

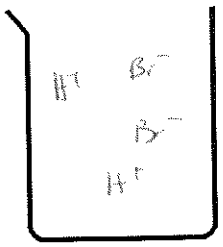
.3 · .05 = 0.015

3. To a beaker, 50mL of 0.2M HBr is added to 50 mL of 0.3M KOH.

a. Write the complete balanced equation and complete an ISE table below.

$H^+ + OH^- \rightarrow H_2O$

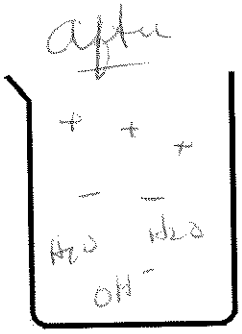
	.01	.015	
	-.01	-.01	+.01
	0	.005	



b. Which reactant is the limiting reactant?

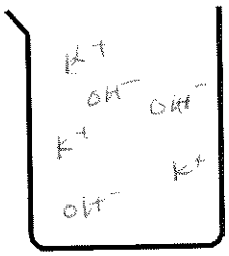
H+ or HCl

Excess
M = mol / L
.005 / .1L =



c. How much water is produced?

.01 | 1 H2O / 1 OH- | 18g / 1mol = 0.18



d. Determine the following concentrations:

	H^+	Br^{-1}	K^+	OH^-
Before:	.2	.2	.3	.3
After:	0	.1	.15	.05

Dilutions
Volume doubles
so Conc. Cut in half.

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

Before

do your best on Brepotrons.

4. To a beaker, 50mL of 0.2M $CaCl_2$ is added to 50 mL of 0.4M Na_3PO_4 forming a white solid at the bottom of the solution.

M·L = mol
.2 · .05 = .01
.4 · .05 = .02

Complete an ISE table for the following reaction

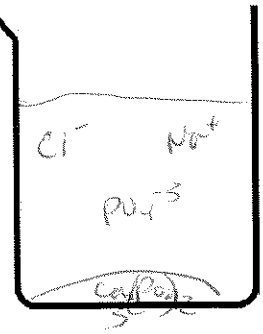
$3CaCl_2 + 2Na_3PO_4 \rightarrow Ca_3(PO_4)_{2(s)} + 6NaCl_{(aq)}$

I	.01	.02	0	0
S	.01	-.0066	+.0033	
E	0	.013		

Stoich
.01 | 2/3 = .0066

f. Draw a picture of the final beaker. Show particle proportionality.

do your best



g. What are the spectator ions in this process?

h. What ion should not be present in the drawing to the right?

Ca+2

i. Determine the following concentrations:

	Ca^{2+}	Cl^{-1}	Na^{+1}	PO_4^{-3}
Before	.2	.4	.12	.4
After.	0	.4 ↓ .2	.12 ↓ .06	.13M

Cut in 1/2

.013 / .1 = .13

Note: If you cannot determine the concentration proportionally, simply use the ISE table, divide new moles by new volume.

5. A 0.2M $Ca(NO_3)_2$ 28mL is added to 30mL of 0.4M NaI forming solid CaI_2.

a. Which ion is precipitated out causing the reaction to stop? (no calculator)

b. Draw a picture of final beaker. If you are stuck write out an ISE table and calculate.