Neutralization Lab Report
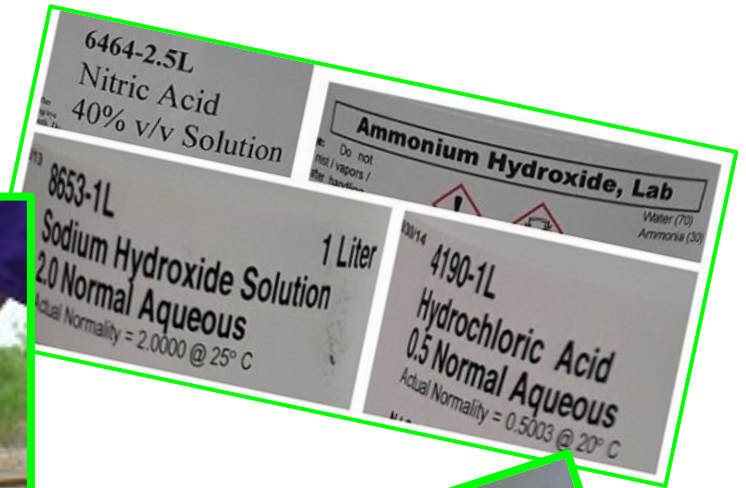
Anna Adams | 5th Period | Honors Chemistry | 15 April 2022

Also featured on oproot.com under the experiment page!

https://www.oproot.com/neutralization/

Materials

- NaOH (sodium hydroxide)
- HCl (hydrochloric acid)
- HNO_3 (nitric acid)
- NH4OH (ammonium hydroxide)
- Distilled water
- Glass cups in lieu of wells
- Pipettes
- Bromothymol Blue indicator
- Beakers measuring at least 250 mL

Data Table

| Well	Substance	Color Indicated	Acid Or Base	Substance Added	Drops Added	New Color
1	NaOH	Blue	Base	HCl	34	Yellow
2	HNO_3	Yellow	Acid	HCl	80	Lighter Yellow
3	NH_4OH	Blue	Base	HCl	15	Yellow
4	HCl	Yellow	Acid	NaOH	14	Blue
5	HNO_3	Yellow	Acid	NaOH	27	Blue
6	NH_4OH	Blue	Base	NaOH	40	Darker Blue

Prompted Responses

Which of the compounds in the tables are acids? Which are bases?

The nitric acid and hydrochloric acid solutions were acids. The sodium hydroxide and ammonium hydroxide solutions were bases.

What did you observe when you mixed an acid with a base?

The anticipated result would have been witnessing the color change to green, but due to personal error, I witnessed the new solution grow lighter and then suddenly turn yellow.

Label the acid, base, and ionic salt in this chemical equation:

$HCl(aq) + NaOH(aq) --> NaCl(aq) + H2O(l)$
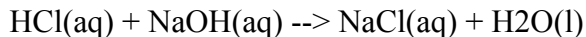
The acid is HCl (hydrochloric acid). The base is NaOH (sodium hydroxide). The ionic salt is NaCl (sodium chloride).

Complete and balance the equations below:

Reactions with HCl:

Well 1: $NaOH \ (aq) + HCl \ (aq) \rightarrow H_2O + NaCl$

Well 2: $HNO_3 \ (aq) + HCl \ (aq) \rightarrow$ *no reaction*

Well 3: $NH_4OH \ (aq) + HCl \ (aq) \rightarrow H_2O + NH_4Cl$

Reactions with NaOH:

Well 4: $HCl \ (aq) + NaOH \ (aq) \rightarrow H_2O + NaCl$

Well 5: $HNO_3 \ (aq) + NaOH \ (aq) \rightarrow H_2O + NaNO_3$

Well 6: $NH_4OH \ (aq) + NaOH \ (aq) \rightarrow$ *no reaction*

Write a balanced equation for the reaction that occurs when sulfuric acid $H_2SO_4 \ (aq)$ reacts with magnesium hydroxide $Mg(OH)_2 \ (aq)$:

$2H_2SO_4 \ (aq) + Mg(OH)_2 \ (aq) \rightarrow Mg(SO_4)_2 + 2H_2O$
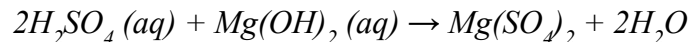
Calculations

NaOH

$$M_1V_1 = M_2V_2$$

$M_1 = 2.00\ M\quad V_1 = ?\quad M_2 = .10\ M\quad V_2 = .25\ L$

$(.10\ M \times .25\ L) \div 2.00\ M = .0125\ L\ or\ 12.50\ mL$

HNO₃

$M = ((\ P \times d\ ) \div m) \div .10$

$P = 40.00\quad d = 1.42\ g/mL\quad m = 63.01\ g/mol$

$((\ 40.00 \times 1.42) \div 63.01) \div .10 = 9.01\ M$

$$M_1V_1 = M_2V_2$$

$M_1 = 9.01\ M\quad V_1 = ?\quad M_2 = .10\ M\quad V_2 = .25\ L$

$(.10\ M \times .25\ L) \div 9.01\ M = .00277\ L\ or\ 2.77\ mL$

NH₄OH

$M = ((\ P \times d\ ) \div m) \div .10$

$P = 27.00\quad d = .90\ g/mL\quad m = 35.04\ g/mol$

$((\ 27.00 \times .90) \div 35.04) \div .10 = 6.93\ M$

$$M_1V_1 = M_2V_2$$

$M_1 = 6.93\ M\quad V_1 = ?\quad M_2 = .10\ M\quad V_2 = .25\ L$

$(.10\ M \times .25\ L) \div 6.93\ M = .00361\ L\ or\ 3.61\ mL$

HCl

$$M_1V_1 = M_2V_2$$

$M_1 = .50\ M\quad V_1 = ?\quad M_2 = .10\ M\quad V_2 = .25\ L$

$(.10\ M \times .25\ L) \div .50\ M = ..05\ L\ or\ 50.00\ mL$