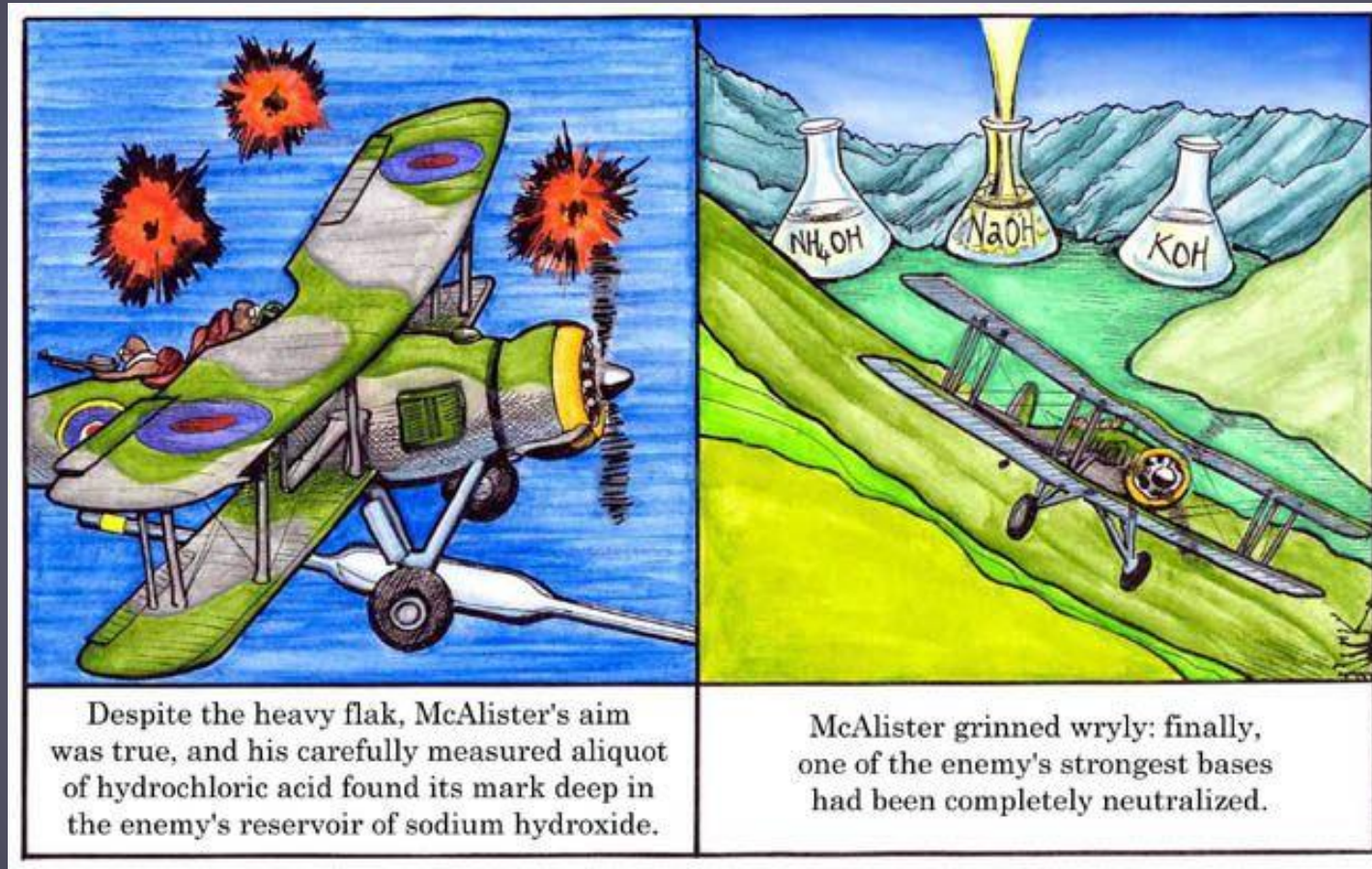# Neutralization Problems

pintrest.com

Outcome:

1-06 Calculate the concentration or volume of an acid or base from the concentration and volume of acid or base required for neutralization.

Solving Neutralization Problems

We can solve for concentration or volume of one reactant in a neutralization reaction if we know the concentration and volume of the other reactant.

We will use stoichiometry, just like in grade 11…

Steps:

1. Write the **BALANCED** chemical equation.
2. Convert to **MOLES**.

      i.e. Use the concentration and volume of the known acid/base to find the number of moles.

3. Use **STOICHIOMETRY** (**MOLE** ratios)to find the **MOLES** of the **UNKNOWN** acid or base.
4. **CONVERT** the answer in step 3 to the units asked for in the question.
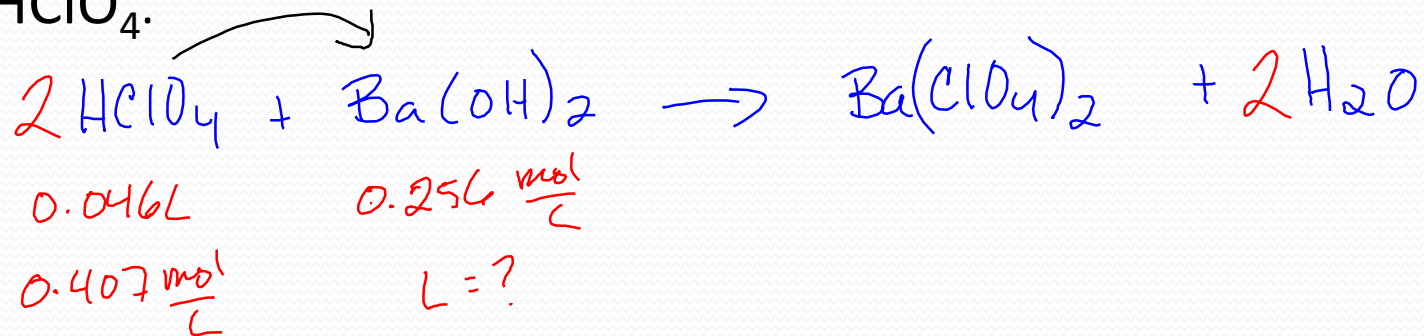
Example Neutralization Problems

1. In the reaction of 35.0mL of drain cleaner (NaOH), 50.08mL of 0.409M HCl must be added to neutralize the base. What is the concentration of the base?

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

0.035L $0.409 \frac{mol}{L}$ ←
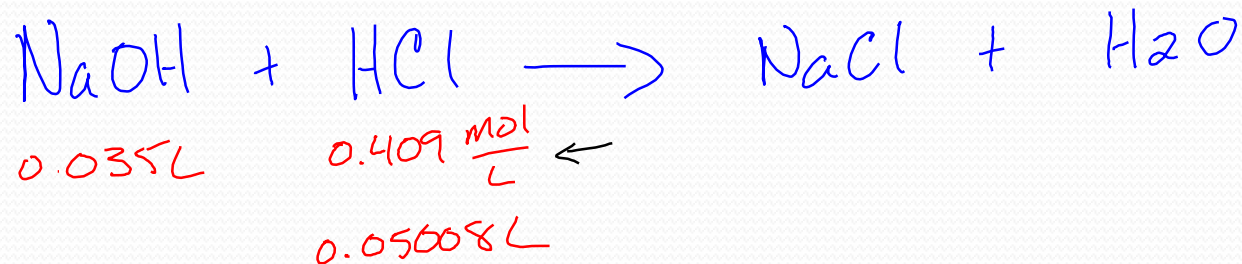
0.05008L

$$0.05008 \cancel{L} \times \frac{0.409 \, mol}{1 \cancel{L}} = 0.0205 \, \cancel{mol \, HCl} \times \frac{1 \, mol \, NaOH}{1 \, mol \, HCl} = \frac{0.0205 \, mol \, NaOH}{0.035L} = 0.59 \frac{mol}{L} \, NaOH$$

Example Neutralization Problems

2. Calculate the volume of 0.256mol/L $Ba(OH)_2$ that must be added to neutralize 46mL of 0.407mol/L $HClO_4$.

$$2 HClO_4 + Ba(OH)_2 \longrightarrow Ba(ClO_4)_2 + 2 H_2O$$

0.046L   0.256 mol/L

0.407 mol/L   L = ?

$$0.046 L \times \frac{0.407\ mol}{1\ L} = 0.0187\ mol\ HClO_4 \times \frac{1\ mol\ Ba(OH)_2}{2\ mol\ HClO_4} = 0.00936\ mol\ Ba(OH)_2 \times \frac{1\ L}{0.256\ mol}$$

$$NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$$

$$NH_4OH$$
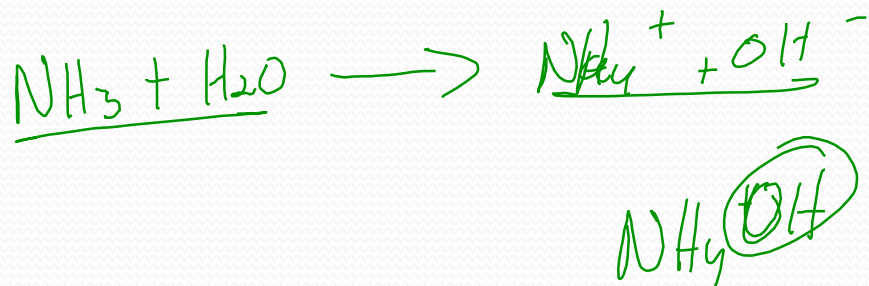
$$= 0.0365 L$$

$$= 36.5\ mL$$

Neutralization Problems

Try these ones...

1. How many milliliters of 0.1M sulfuric acid are required to neutralize 10.0g of sodium hydroxide?

H_2SO_4

$$H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$$
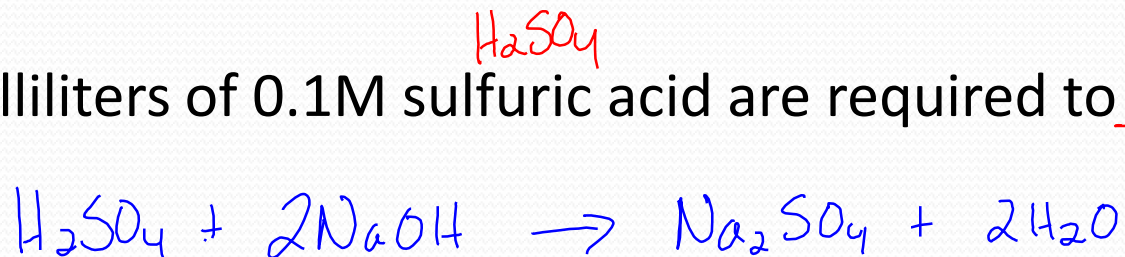
$$10.0 \, g \times \frac{1 \, mol}{40.01 \, g} = 0.25 \, mol \, NaOH \times \frac{1 \, mol \, H_2SO_4}{2 \, mol \, NaOH} = 0.125 \, mol \, H_2SO_4 \times \frac{1 \, L}{0.1 \, mol} = \boxed{1.25 \, L \\ OR \\ 1250 \, mL}$$

Neutralization Problems

Try these ones...

2. Calculate the molarity of a 47mL solution of magnesium hydroxide if it takes 56.2 mL of 0.25M phosphoric acid to neutralize.

$0.45 \frac{mol}{L}$

$$3\,Mg(OH)_2 + 2H_3PO_4 \longrightarrow Mg_3(PO_4)_2 + 6H_2O$$

$$0.25\frac{mol}{L} \times 0.0562L = 0.0141\,mol\,H_3PO_4 \times \frac{3\,mol\,Mg(OH)_2}{2\,mol\,H_3PO_4} = \frac{0.21\,mol\,Mg(OH)_2}{0.047L} = 0.45\frac{mol}{L}$$