

A *neutralization reaction* is a double displacement reaction between an acid and a base. An acid and a base react to form a salt and water. These reactions occur because of the formation of the stable water molecule. Neutralization reactions are accompanied by the liberation of heat.

In this experiment, you will be observing these three types of reactions.

Procedure

Make the additions indicated below, carefully noting all observations. If you are uncertain of a particular result, repeat the addition. Keep good notes on how the reagents look before and after you mix them; feel the test tube to see if any heat is evolved after combining two reagents. Look carefully for the formation of solids and gases; record what you see. In general, use all of your senses (except taste) to get information.

Use approximately 1 mL of each solution unless otherwise indicated. One mL gives about $\frac{1}{4}$ inch of solution in the bottom of the smaller test tubes in your lab drawer.

Don't rush! Give the reactions time to occur.

Double displacement reactions

- DD1. To 0.1 M MgCl_2 , add 0.1 M NaOH dropwise, mixing after each addition. Continue until an equal volume of NaOH has been added.
- DD2. Quickly, add up to 2 mL of 2.0 M NaOH to an equal volume of 1.0 M H_2SO_4 .
- DD3. To 0.1 M ZnCl_2 , add an equal volume of 0.1 M Na_2S dropwise.
- DD4. To solid CaCO_3 , add 1.0 M HCl dropwise.
- DD5. To solid CaCO_3 , add 1.0 M H_2SO_4 dropwise.
- DD6. To 0.1 M CuCl_2 , add 0.1 M NH_4OH dropwise, shaking and observing carefully what happens with the addition of each drop.

Single displacement reactions

- SD1. Drop a piece of zinc metal into 3.0 M H_2SO_4 .
- SD2. Drop a piece of zinc metal into 0.1 M CuSO_4 .