Experiment: Vinegar vs. Limestone

A very simple and fun science experiment involves limestone and a little vinegar. A chemical reaction occurs when vinegar comes in contact with limestone. Small bubbles rise off the limestone and a little heat is produced by the chemical reaction. The vinegar and limestone yield several different compounds once the reaction has occurred. There are several reasons to why and how these reactions occur.

The Reaction

Vinegar is diluted acetic acid, and limestone is calcium carbonate. Acetic acid is as it's named, an acid. Calcium carbonate is a base, and is a common ingredient in indigestion tablets. Heat is also always produced during a reaction of an acid and a base. Acids and bases create salts and water when mixed together.

Products of the Reaction

The fizzing little bubbles forming are carbon dioxide rising to the surface of the vinegar. These rising bubbles are the same as bubbles in soda pop, beer and wine and is referred to as "effervescence." The vinegar becomes pure water, and a calcium salt is called calcium acetate, $Ca(C_2H_3O_2)_2$, is formed. Calcium acetate is commonly used as a food additive and buffer, especially in candy. Calcium acetate is also helpful against kidney disease, due to it's ability to bind with phosphate and lower phosphate levels in the kidneys.

Bonds Created

Bonds are what bind together chemical compounds, and keep them together. When these bonds are destroyed, a reaction occurs. When bonds are broken, energy is released which produces heat. Vinegar reacting with limestone breaks the bonds of calcium carbonate and acetic acid. New bonds are created out of the broken compounds, which are the products of the reaction. In this case, the bond of calcium acetate is formed due to the reaction.

Chemical Equation

$CaCO3 + 2CH3COOH = Ca(CH3COO)2 + H2O + CO2$. Limestone ($CaCO3$) combined with vinegar ($2CH3COOH$) yields calcium acetate $Ca(CH3COO)2$, water ($H20$) and carbon dioxide ($CO2$). This equation shows how each compound is broken and bonded, and the products of the reaction.