

Rainbow Magic

History & Significance:

The word acid comes from the Latin word *acere*, which means "sour." Most acids taste sour, i.e. vinegar, sour milk, lemon juice. They have been isolated and extracted as early as the 1200's C.E. The word alkaline, synonymous with basic, comes from the Arabic *al-qily*, which means "to roast in a pan" or "the calcinated ashes of plants." Bases have been extracted and in writing as early as 900 C.E. or earlier.^[1] Acids and bases have the ability to neutralize each other and both have unique reactive chemical properties. We use the pH scale to measure the relative acidity or basicity of a solution; depending on this the solution will behave differently with other chemicals. Indicators are other chemicals that make color changes at specific pH ranges in a solution. Joseph Louis Gay-Lussac discovered acid-base indicators in litmus in 1824 C.E. and since then many indicators have been discovered.^[2] In chemistry, the pH of a solution effects how molecules react and behave. For example, our bodies require a certain pH in order for biological reactions to function properly. Acids and bases can be highly charged chemicals and very reactive; strong acids and bases can cause a lot of damage if handled wrong.

How it works:

The demonstration is supposed to turn 6 beakers of what appears to be nothing into the 6 primary colors of the rainbow. 3 indicators are mixed together in different amounts to produce specific colors: phenolphthalein turns pink, p-nitrophenol turns yellow, and thymolphthalein turns blue. Using the phenolphthalein and the p-nitrophenol (pink and yellow) we can make a red color once we reach a specific pH. The rest of the beakers are prepared in a similar way, combining different amounts of each indicator to show a specific color. The beakers are initially filled with several drops of the indicators and a small amount of ethanolic sulfuric acid, which is a strong acid. The pitcher is filled with dilute sodium hydroxide, a strong base, which when added to the beakers begins to neutralize the sulfuric acid, raising the pH and lowering acidity. Once enough base is added, the solution will be basic enough for the indicators to show their pretty colors. A small beaker full of sulfuric acid is added to the pitcher, so when all the beakers are added back to the pitcher the solution will be acidic enough as to keep the indicators from showing.

Materials:

1. 6 Beakers
2. Phenolphthalein
3. p-Nitrophenol
4. Thymolphthalein
5. 2L pitcher
6. Sulfuric acid
7. Sodium hydroxide
8. Distilled water

References:

- ¹ <http://dwb4.unl.edu/Chem/CHEM869R/CHEM869RLinks/www.nidlink.com/7Ejfromm/lavoisier.htm>
- ² <http://chemistry.about.com/cs/history/a/aa020204a.htm>