# Indicator, Acid-Base Encyclopedia Article

## Indicator, Acid-Base

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# Indicator, Acid-Base

An acid-base indicator is often a complex organic dye that undergoes a change in **color** when the **pH** of a **solution** changes over a specific pH range. Many plant pigments and other **natural products** are good indicators, and synthetic ones like phenolphthalein and methyl red are also available and widely used.**Paper** dipped in a mixture of several indicators and then dried is called pH paper, useful for obtaining the approximate pH of a solution. Blue litmus paper turns red in acidic solution, and red litmus paper turns blue in basic solution. The litmus test for acidity or basicity has been taken into the language to mean a definitive yes-or-no test for almost anything.

The pH at which the color of an indicator changes is called the transition interval. Chemists use appropriate indicators to signal the end of an acid-base **neutralization** reaction. Such a reaction is usually accomplished by **titration**: slowly adding a measured quantity of the base to a measured quantity of the acid (or vice versa) from a **buret**. (A buret is a long tube with **volume** markings for precise measurement and a stopcock at the bottom to control the flow of liquid.) When the reaction is complete, that is, when there is no excess of acid or base but only the reaction products, that is called the endpoint of the titration. The indicator must change color at the pH which corresponds to that endpoint.

The indicator changes color because of its own neutralization in the solution. Different indicators have different transition intervals, so the choice of indicator depends on matching the transition interval to the expected pH of the solution just as the reaction reaches the point of complete neutralization. Phenolphthalein changes from colorless to pink across a range of pH 8.2 to pH 10. Methyl red changes from red to yellow across a range of pH 4.4 to pH 6.2. Those are the two most common indicators, but others are available for much higher and lower pH values. Methyl violet, for example, changes from yellow to blue at a transition interval of pH 0.0 to pH 1.6. Alizarin yellow R changes from yellow to red at a transition interval of pH 10.0 to pH 12.1. Other indicators are available through most of the pH range, and can be used in the titration of a wide range of weak **acids and bases**.