

## Acid-Base Indicators

### Useful Weak Acids and Bases

#### What is an acid-base indicator?

An acid-base indicator is a weak acid or a weak base. The undissociated form of the indicator is a different color than the ionic form of the indicator. An Indicator does not change color from pure acid to pure alkaline at specific hydrogen ion concentration, but rather, color change occurs over a range of hydrogen ion concentrations. This range is termed the *color change interval*. It is expressed as a pH range.

#### How is an indicator used?

Weak acids are titrated in the presence of indicators which change under slightly alkaline conditions. Weak bases should be titrated in the presence of indicators which change under slightly acidic conditions.

#### What are some common acid-base indicators?

Several acid-base indicators are listed below, some more than once if they can be used over multiple pH ranges. Quantity of indicator in aqueous (aq.) or alcohol (alc.) solution is specified. Tried-and-true indicators include: thymol blue, tropeolin OO, methyl yellow, methyl orange, bromphenol blue, bromcresol green, methyl red, bromthymol blue, phenol red, neutral red, phenolphthalein, thymolphthalein, alizarin yellow, tropeolin O, nitramine, and trinitrobenzoic acid. Data in this table are for sodium salts of thymol blue, bromphenol blue, tetrabromphenol blue, bromcresol green, methyl red, bromthymol blue, phenol red, and cresol red.

Indicator	pH Range	Quantity per 10 ml	Acid	Base
Thymol Blue	1.2-2.8	1-2 drops 0.1% soln. in aq.	red	yellow
Pentamethoxy red	1.2-2.3	1 drop 0.1% soln. in 70% alc.	red-violet	colorless
Tropeolin OO	1.3-3.2	1 drop 1% aq. soln.	red	yellow
2,4-Dinitrophenol	2.4-4.0	1-2 drops 0.1% soln. in 50% alc.	colorless	yellow
Methyl yellow	2.9-4.0	1 drop 0.1% soln. in 90% alc.	red	yellow
Methyl orange	3.1-4.4	1 drop 0.1% aq. soln.	red	orange
Bromphenol blue	3.0-4.6	1 drop 0.1% aq. soln.	yellow	blue-violet
Tetrabromphenol blue	3.0-4.6	1 drop 0.1% aq. soln.	yellow	blue
Alizarin sodium sulfonate	3.7-5.2	1 drop 0.1% aq. soln.	yellow	violet
$\alpha$ -Naphthyl red	3.7-5.0	1 drop 0.1% soln. in 70% alc.	red	yellow
<i>p</i> -Ethoxychrysoidine	3.5-5.5	1 drop 0.1% aq. soln.	red	yellow
Bromcresol green	4.0-5.6	1 drop 0.1% aq. soln.	yellow	blue
Methyl red	4.4-6.2	1 drop 0.1% aq. soln.	red	yellow
Bromcresol purple	5.2-6.8	1 drop 0.1% aq. soln.	yellow	purple
Chlorphenol red	5.4-6.8	1 drop 0.1% aq. soln.	yellow	red

Bromphenol blue	6.2-7.6	1 drop 0.1% aq. soln.	yellow	blue
<i>p</i> -Nitrophenol	5.0-7.0	1-5 drops 0.1% aq. soln.	colorless	yellow
Azolitmin	5.0-8.0	5 drops 0.5% aq. soln.	red	blue
Phenol red	6.4-8.0	1 drop 0.1% aq. soln.	yellow	red
Neutral red	6.8-8.0	1 drop 0.1% soln. in 70% alc.	red	yellow
Rosolic acid	6.8-8.0	1 drop 0.1% soln. in 90% alc.	yellow	red
Cresol red	7.2-8.8	1 drop 0.1% aq. soln.	yellow	red
$\alpha$ -Naphtholphthalein	7.3-8.7	1-5 drops 0.1% soln. in 70% alc.	rose	green
Tropeolin OOO	7.6-8.9	1 drop 0.1% aq. soln.	yellow	rose-red
Thymol blue	8.0-9.6	1-5 drops 0.1% aq. soln.	yellow	blue
Phenolphthalein	8.0-10.0	1-5 drops 0.1% soln. in 70% alc.	colorless	red
$\alpha$ -Naphtholbenzein	9.0-11.0	1-5 drops 0.1% soln. in 90% alc.	yellow	blue
Thymolphthalein	9.4-10.6	1 drop 0.1% soln. in 90% alc.	colorless	blue
Nile blue	10.1-11.1	1 drop 0.1% aq. soln.	blue	red
Alizarin yellow	10.0-12.0	1 drop 0.1% aq. soln.	yellow	lilac
Salicyl yellow	10.0-12.0	1-5 drops 0.1% soln. in 90% alc.	yellow	orange-brown
Diazo violet	10.1-12.0	1 drop 0.1% aq. soln.	yellow	violet
Tropeolin O	11.0-13.0	1 drop 0.1% aq. soln.	yellow	orange-brown
Nitramine	11.0-13.0	1-2 drops 0.1% soln in 70% alc.	colorless	orange-brown
Poirrier's blue	11.0-13.0	1 drop 0.1% aq. soln.	blue	violet-pink
Trinitrobenzoic acid	12.0-13.4	1 drop 0.1% aq. soln.	colorless	orange-red

Primary References:

*Lange's Handbook of Chemistry*, 8th Edition, Handbook Publishers Inc., 1952.  
*Volumetric Analysis*, Kolthoff & Stenge, Interscience Publishers, Inc., New York, 1942 and 1947.