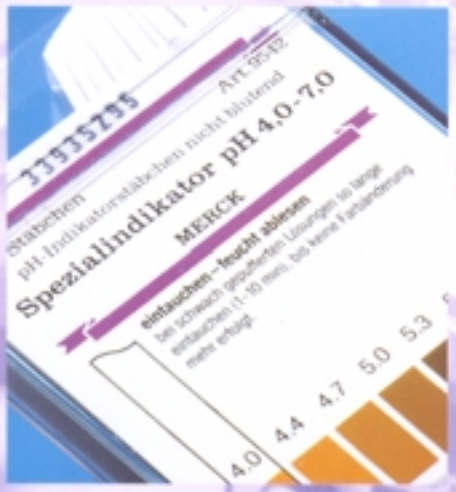
pH Indicators
Analysis within Seconds



MERCK

pH Indicator Strips

Economic in price

In practice, it is normally quite sufficient to be able to measure pH in full units or in tenths of a unit. For this type of determination, as carried out in many laboratories, our various types of indicator paper, strips and liquids have proven themselves over many years.

pH indicator paper has been on the market for decades in booklet and roll form. However, these forms are being more and more replaced by the more modern strip form (see next page). Indicator paper consists of high quality filter paper impregnated with indicator or indicator mixture. The table alongside shows the various types of booklet and rolls available

Order No.	Designation	pH range (*transition range)	Graduation (pH units)	Roll length/ No. of strips
	pH paper			
	Rolls			
1.09565.0001	pH box	0.5 -13.0	0.5	3 x 4.8 m
1.09568.0001	Refill rolls, pH 0.5-5.0	0.5 - 5.0	0.5	6 x 4.8 m
1.09569.0001	Refill rolls, pH 5.5-9.0	5.5 - 9.0	0.5	6 x 4.8 m
1.09570.0001	Refill rolls, pH 9.5-13.0	9.5 -13.0	0.5	6 x 4.8 m
1.10962.0001	Universal indicator	1 -14.0	1	6 x 4.8 m
1.10232.0001	Refill rolls			6 x 4.8 m
1.09526.0001	Universal indicator	1 -10.0	1	6 x 4.8 m
1.09527.0001	Refill rolls			6 x 4.8 m
1.09560.0001	Acilit	0.5 - 5.0	0.5	6 x 4.8 m
1.09568.0001	Refill rolls			6 x 4.8 m
1.09564.0001	Neutralit	5.5 - 9.0	0.5	6 x 4.8 m
1.09569.0001	Refill rolls			6 x 4.8 m
1.09562.0001	Alkalit	9.5 -13.0	0.5	6 x 4.8 m
1.09570.0001	Refill rolls			6 x 4.8 m
1.09486.0001	Litmus paper, blue	pH <7 red / >7 blue*		6 x 4.8 m
1.09489.0001	Litmus paper, red	pH <7 red / >7 blue*		6 x 4.8 m
	Booklets			
1.09525.0001	Universal indicator	1 -10.0	1	6 x 100
1.09555.0001	Special indicator	3.8 - 5.4	0.2 - 0.3	6 x 100
1.09556.0001	Special indicator	5.4 - 7.0	0.2 - 0.4	6 x 100
1.09557.0001	Special indicator	6.4 - 8.0	0.2 - 0.3	6 x 100
1.09558.0001	Special indicator	8.2 -10.0	0.2 - 0.4	6 x 100
1.09514.0001	Congo paper	pH <3 blue-violet / >5 red-orange	-	6 x 100
1.09516.0001	Litmus paper, blue	pH <7 red / >7 blue*	-	6 x 100
1.09517.0001	Litmus paper, red	pH <7 red / >7 blue*	-	6 x 100
1.09518.0001	Litmus paper, neutral	pH <7 red / >7 blue*	-	6 x 100
1.09521.0001	Pnenolphthalein paper	pH <8.5 colourless / >8.5 red	-	6 x 100

pH Indicator Strips, Non-Bleeding

All-round versatility

Indicator strips incorporate special indicator dyes covalently bound to the cellulose of the reagent paper. They have the following properties:

- Clearly defined colour differences between pH ranges
- Easy to read due to optimal contrast between reaction zones
- Highly resistant to light
- No bleeding of the indicator substances (i.e. no contamination of the test medium)
- Can be left indefinitely in the test medium
- Highly accurate, even with weak buffers, subsequent to a waiting period of 5-10 minutes for indicators to reach equilibrium
- Long, stable plastic strips offer the user protection from the test medium
- Can be used for the measurement of weakly coloured and turbid solutions as the strips can be briefly rinsed with distilled water without influencing the colour reaction.
- No contamination of the test medium (advantageous when measuring the pH of foodstuffs like meat and bread)
- Minimal protein error
- Can be used for the pH measurement of human and animal body fluids and excreta (saliva, urine, faeces)

- Reliable pH control of precipitation reactions in analytical chemistry

Minimum stability of pH paper and pH strips: 3 years if stored at 10-25 °C, dry and protected from laboratory atmosphere.

Order No.	Designation	pH range	pH units	No. of strips
	pH indicator solution			
1.09535.0001	Universal indicator	0 -14	1	100
1.09531.0001	Acilit indicator	0 - 6.0	0.5	100
1.09533.0001	Neutralit indicator	5.0 -10	0.5	100
1.09532.0001	Acilit indicator	7.5 -14.0	0.5	100
1.09584.0001	Special indicator	2.0 - 9.0	0.5	100
1.09540.0001	Special indicator	0 - 2.5	0.3 - 0.5	100
1.09541.0001	Special indicator	2.5 - 4.5	0.2 - 0.5	100
1.09542.0001	Special indicator	4.0 - 7.0	0.2 - 0.5	100
1.09543.0001	Special indicator	6.5 -10.0	0.2 - 0.5	100
1.09545.0001	Special indicator	11.0 -13.0	0.2 - 0.5	100
1.09547.0001	Special indicator (for pH measurement of meat)	5.2 - 7.2	0.1 - 0.2	100
1.14606.0001	Agroquant pH (lime requirement) in soil (with PE bottle, syringe, spatula, test vessel)	2.0 - 9.0	0.5	100

Liquid pH Indicators

Special types

When using liquid pH indicators, the test solution should, if possible, be colourless and clear. If the test solution has a slight inherent colour, test kits incorporating a sliding comparison unit can be used; this then compensates for the initial colour. Solutions that are turbid or have a strong colour can often be made suitable by filtration or treatment with activated charcoal. However, if a high degree of accuracy is required, turbidity or colour should not be allowed to interfere with the indicator colour development.

The pH is determined by adding a few drops of indicator solution to a certain volume of test solution and comparing the colour developed with a colour standard. The volumes involved depend on the analysis to be performed. The colour standards are either waterproof colour charts or comparison units comprising a 10 ml cuvette with large colour blocks located on both sides. pH measurement with liquid indicators have the following advantages:

- Rapid measurement as no waiting time for equilibrium to set in is involved
- High degree of measuring accuracy even with weakly buffered solutions
- Suitable for determinations involving drinking-, boiler- and waste water, aquarium-, surface- and swimming pool water and soil extract.
- Stable for at least 2 years if stored between 10-25 °C

Liquid pH indicators are available in blister packs (photo left) or plastic bottles (photo right), and include all the necessary accessories.

Order No.	Designation	pH range	pH units	No. of strips
	pH indicator solution			
1.14655.0001	Aquamerck pH in fresh water (blister pack)	5.0 - 9.0	0.5	200
1.14656.0001	Aquamerck pH in sea water (blister pack)	7.1 - 8.9	0.3	200
1.14669.0001	Aquamerck pH in swimming pool water (blister pack)	6.5 - 8.2	0.2 - 0.3	200
1.08027.0001	Aquamerck pH (with comparison unit)	4.5 - 9.0	0.5	400
1.08038.0001	Aquamerck pH (with test vessel)	4.5 - 9.0	0.5	100
1.08043.0001	Aquamerck pH indicator solution (refill pack for 1.08038.0001)	as original pack		200
1.09177.0001	Aquamerck pH indicator solution, pH 0-5	0.0 - 5.0	0.5	100 ml
1.09176.0001	Aquamerck pH indicator solution, pH 9-13	9.0 -13.0	1	100 ml
1.09175.0001	Aquamerck pH indicator solution, pH 4-10	4.0 -10.0	0.5	100 ml
1.09175.1001	Aquamerck pH indicator solution, pH 4-10	4.0 -10.0	0.5	1 l
1.11137.0001	Aquamerck pH test	4.5 - 9.0	0.5	200

pH Indicators

The basis

pH indicators are still of great value as rapid end-point indicators in acid -base titrations. In contrast to the already described indicator strips, indicator paper and indicator solutions, pH indicators are used for the quantitative determination of the acid or basic content of a solution. The indicator has one colour prior to the equivalent point and another at the equivalent point; the end of the titration can thus be observed visually.

How does this difference in colour come about? pH indicators are organic dyes with either acid or basic characteristics; in dissociated form they have a different colour and constitution to that of their ionic form. On adding an acid or base, colour change does not set in immediately at a certain pH value but rather within a certain pH range. This usually extends over 2 pH units and is characteristic for each indicator, as is shown on the table opposite.

Each titration has the objective of determining the equivalent point of the reaction being carried out. Due to the hydrolytic processes involved, this is not always at the neutral point (pH 7) but more towards the acid or basic range.

It is thus important to select an indicator that has the same or almost the same pH at the point of change as the equivalent point of the system being titrated. For this reason, there are a number of rules that should be adopted when using pH indicators:

- When titrating strong acids with strong bases, a whole range of indicators can be used whose point of change lie in the weakly acid, neutral or weakly basic areas.
- Weak acids can be titrated with strong bases if the point of change of the indicator is in the weak alkaline area.
- Weak bases can be titrated with strong acids if the point of change of the indicator is in the weak acid area.
- Titration of weak acids with weak bases and vice versa produce inaccurate results. Very few indicators are suitable for this particular type of titration and they have to be selected carefully. The correct indicator can only be selected by carrying out a comparative titration.

Cat. No.	Designation	Point of change / colour change	
	pH Indicator		
1.01398.	Malachite green oxalate	0.0 green	- 2.0 green-blue
1.01310.	Brilliant green	0.0 yellow	- 2.6 green
1.15935.	Eosin yellowish	0.0 yellow	- 3.0 green fluoresc.
1.15936.	Erythrosine B	0.0 yellow	- 3.6 red
1.15944.	Methyl green	0.1 yellow	- 2.3 blue
1.15945.	Methyl violet	0.1 yellow	- 2.7 violet
1.00623.	Picric acid	0.2 colourless	-1.0 yellow
1.05225.	Cresol red	0.2 red	-1.8 yellow
1.01408.	Crystal violet	0.8 yellow	- 2.6 blue/violet
1.05228.	m-Cresol purple	1.2 red	- 2.8 yellow
1.08176.	Thymol blue	1.2 red	- 2.8 yellow
1.08682.	p-Xylenol blue	1.2 red	- 2.8 yellow
1.11473.	2,2'2",4 4'-penta-methoxytri-phenyl carbinol	1.2 red	- 3.2 colourless
1.15934.	Eosin, bluish	1.4 colourless	- 2.4 pink fluoresc.
1.02282.	Quinaldine red	1.4 colourless	- 3.2 pink
1.03464.	2,4-Dinitro phenol	2.8 colourless	- 4.7 yellow
1.03055.	4-(Dimethylamino) azobenzol	2.9 red	- 4.0 yellow/orange
1.03022.	Bromochlorophenol blue	3.0 yellow	- 4.6 blue/violet
1.08122.	Bromophenol blue	3.0 yellow	- 4.6 blue/violet
1.01340.	Congo red	3.0 blue	- 5.2 yellow/orange
1.01322.	Methyl orange	3.1 red	- 4.4 yellow/orange
1.01323.	Methyl orange solution	3.1 red	- 4.4 yellow/orange
1.08121.	Bromocresol green	3.8 yellow	- 5.4 blue
1.03465.	2,5-Dinitrophenol	4.0 colourless	- 5.8 yellow
1.01359.	Mixed indicator 4.5 according to Mortimer	4.3 red	- 5.2 blue
1.06279.	Alizarin sulphonic acid, sodium salt	4.3 yellow	- 6.3 violet
1.06076.	Methyl red	4.4 red	- 6.2 yellow/orange
1.06078.	Methyl red, sodium salt	4.4 red	- 6.2 yellow/orange
1.06130.	Mixed indicator 5	4.4 red/violet	- 5.8 green
1.03024.	Chlorophenol red	4.8 yellow	- 6.4 purple
1.05312.	Litmus	5.0 red	- 8.0 blue
1.03025.	Bromocresol purple	5.2 yellow	- 6.8 purple
1.03023.	Bromophenol red	5.2 orange/yellow - 6.8 purple	
1.06798.	4-Nitrophenol	5.4 colourless	- 7.5 yellow
1.03033.	Bromoxylenol blue	5.7 yellow	- 7.5 blue
1.03026.	Bromothymol blue	6.0 yellow	- 7.6 blue
1.07241.	Phenol red	6.4 yellow	- 8.2 red/violet
1.06794.	3-Nitrophenol	6.6 colourless 8.6 yellow/orange	
1.01369.	Neutral red	6.8 blue/red - 8.0 orange/yellow	
1.05225.	Creosol red	7.0 orange	- 8.8 purple
1.06246.	1-Naphtholphthalein	7.1 brownish	- 8.3 blue/green
1.05228.	m-Cresol purple	7.4 yellow	- 9.0 purple
1.08176.	Thymol blue	8.0 yellow	- 9.6 blue
1.08682.	p-Xylenol blue	8.0 yellow	- 9.6 blue
1.07233.	Phenolphthalein	8.2 colourless	- 9.8 red/violet
1.07727.	Phenolphthalein solution (1% in ethanol)	8.2 colourless	- 9.8 red/violet
1.07238.	Phenolphthalein solution (0.375 % in methanol)	8.2 colourless	- 9.8 red/violet
1.08175.	Thymolphthalein	9.3 colourless	-10.5 blue
1.01331.	Alkali blue	9.4 violet	-14.0 pink
1.06776.	Alizarin yellow GG	10.0 bright yellow- 12.1 brown/yellow	
1.04724.	Indigo carmine	11.5 blue	- 13.0 yellow
1.06810.	Epsilon blue	11.6 orange	- 13.0 violet
1.01307.	Titan yellow	12.0 yellow	- 13.0 red

For package sizes please refer to our price list.

The right choice

Here's how to find the right indicator:

Application area	pH indicator paper	pH indicator strip	pH indicator solution
Measurement in weakly buffered solutions	Not possible	Possible if immersion time (5-10 min) permits	No problems involved
Measurement in the presence of protein or quaternary ammonium salts	Errors possible (protein error)	No problems involved	Errors possible (protein error)
Measurement in weakly coloured solution	Not possible	Possible with limitations	Possible only after destaining
Sample solution required	µl	µl	ml
Contamination of sample by indicator dye	Yes	No	Yes

Indicators may be regarded as being weak acids or weak bases. Their degree of dissociation can hence be influenced by co-solutes like neutral salts, proteins, colloids, organic solvents etc. The temperature also exerts some influence. Thus, when carrying out colorimetric analysis using pH indicators, a number of errors can occur. The most important of these are covered below:

The salt error

This error depends on the concentration and type of neutral salts present as their presence tends to displace the equilibrium of the indicator slightly. This means that, in a number of salt solutions, errors in pH measurement can occur. Correction of the result is normally unnecessary if the concentration of the solution is under 2 mol/l.

This salt error is specific to each indicator, depending on its structure and charge. For example, the salt error in sulphophthalein indicators in concentrated solution is relatively large as the alkaline form of these indicator ions have two negative charges. In solutions of low or medium ionic strength, indicators with a dipolar ionic structure, e.g. methyl orange or methyl red, give rise to negligible errors, as the dipolar ion tends to behave like a neutral molecule. In summary, it can be said that, in the presence of foreign neutral salts, the point of change of the indicator acid is displaced towards the higher hydrogen ion concentration i.e. towards lower pH values whilst that of indicator bases is displaced towards the lower hydrogen ion concentration i.e. towards higher pH values.

The indicator error

The indicator error is the result of the acid or basic nature of the indicator dye and occurs only in solutions that are either not buffered or if so only to a small extent. If the buffer value of the solution to be measured is very small, as is the case with e.g. tap water, river water, distilled water or strongly diluted neutral salt solutions, deviations in pH of up to one whole unit or more can be observed in extreme cases.

In order to avoid these errors, the salt of the indicator rather than the free indicator acid or base should be used when measuring pH. In addition, indicator solution rather than indicator paper should be used; this is because the local indicator concentration on the pH paper is too high so that indicator equilibrium cannot be achieved in such a short time.

The protein error

Protein error occurs due to the binding of the indicator dye; proteins present, due to their amphoteric character, bind the indicator acids to their basic groups and the indicator bases to their acid groups. Colloidal solutions can also interfere with the pH measurement by exerting an absorption effect. The protein error depends largely on the type and quantity of protein present and also on the nature of the indicator; the simpler its structure, e.g. nitrophenol, the less interference of the pH measurement. The protein error, however, can also be utilised to measure the protein content of liquids. As non-bleeding pH strips do not show any protein error, they can be used for measuring the pH of body fluids like urine or saliva.

The alkaloid error

This type of error occurs due to the formation of deposition complexes in a similar fashion to that of protein error.

The alcohol error

This type of error occurs in those solutions containing organic solvents, usually alcohol, in addition to water. Addition of alcohol to the aqueous system results in alteration of the dissociation constants of the solution due to the dielectric constants becoming smaller; this then brings about a shift in the acid-base equilibrium of the solution. In the case of aqueous, methanolic and ethanolic solutions, this shift is practically negligible (a 10 % ethanolic solution shows a pH shift of only 1/10th of a pH unit); however, the shift increases with increasing alcohol concentration (a 70 % ethanolic solution causes a shift of 1.5 pH units). Other solvents can bring about quite different effects.

The temperature error

The temperature effect can occur if pH measurement is carried out using warm or even hot solutions; this is due to the fact that indicator paper and non-bleeding indicator strips are optimised to 20 °C. The temperature effect is caused primarily by the ionic product of the water changing substantially with increase in temperature.

Further information on rapid analysis can be found in the following brochure:

"Aquamerck®, Aquaquant® and Microquant® Test Kits for Mobile Analysis"

Aquamerck®
- Test kits for simple and rapid analysis e.g. for fish farming

Aquaquant®
- Test kits for measuring low concentrations e.g. in the analysis of drinking water

Microquant®
- Robust test kits for the analysis of turbid solutions e.g. waste water

Analysis from A to Z:
Acidity, alkalinity, aluminium, ammonium, calcium, carbonate hardness, carbonic acid, chloride, chlorine, chromium, colour, copper, cyanide, formaldehyde, hydrazine, hydrogen sulphide, iron, magnesium, manganese, nickel, nitrate, nitrite, oxygen, pH, phosphate, residual hardness, silicon, sulphate, sulphite, total hardness, urea, zinc.

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