Technical INFO

CARL ROTH

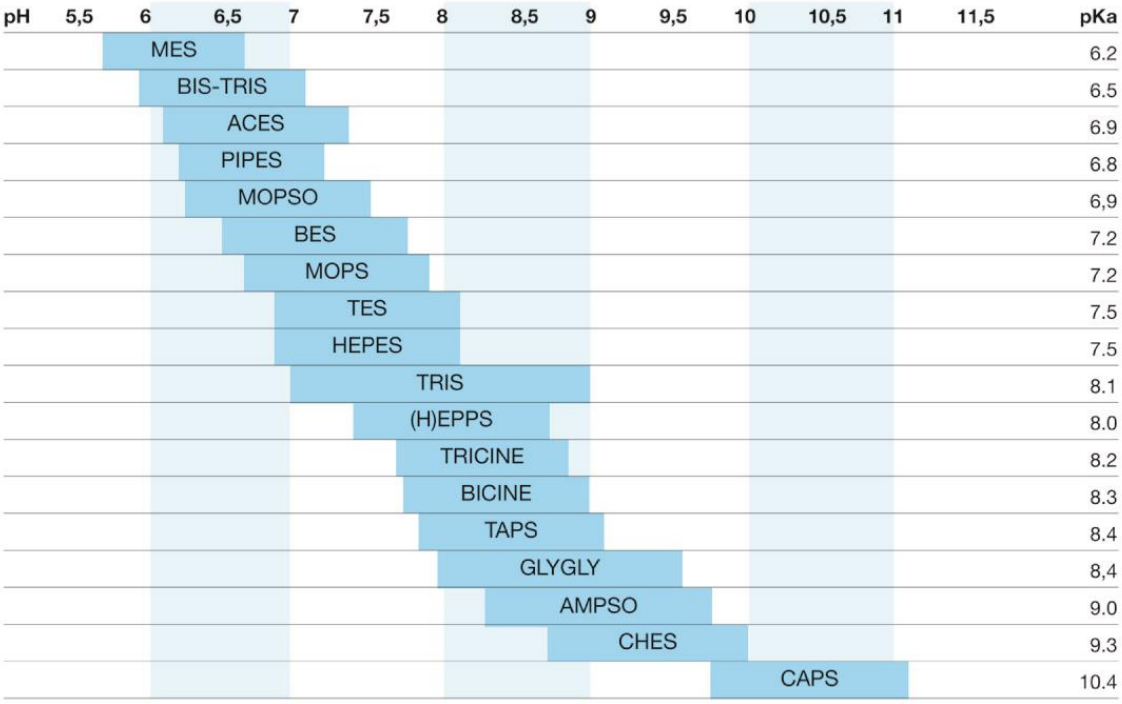
Biological Buffers

PUFFERAN® - for biochemistry, bioinorganic chemistry and molecular genetics

CELLPURE® - especially for cell culture

- Very high purity
- Dissolve easily in water and aqueous media
- No penetration or dissolution of membranes
- Low UV absorption
- No or only very weak complexing with cations
- Chemically stable
- No inhibition or activation of biological or biochemical reactions
- Minimal alteration of pH-value by temperature changes

Buffer range at 20 °C



Buffer Reagents (alphabetical)	pK_a (25 °C)	pH range
ACES	6.78	6.1-7.5
ADA	6.59	6.0-7.2
AMP	6.69	8.7-10.4
AMPSO	9.00	8.3-9.7
BES	7.09	6.4-7.8
BICIN	8.26	7.6-9.0
BIS-TRIS	6.46	5.8-7.2
BIS-TRIS-Propane	6.80	6.3-9.5
Cacodylic acid	6.27	5.0-7.4
CAPS	10.40	9.7-11.1
CAPSO	9.60	8.9-10.3
Carbonate buffers	6.35	6.0-8.0
CHES	9.50	8.6-10.0
Citrate	3.13	2.2-6.5
DIPSO	7.52	7.0-8.2
Glycine	2.35	2.2-3.6
Glycyl-glycine	3.14	2.5-3.8
HEPES	7.48	6.8-8.2
HEPPS, EPPS	8.00	7.6-8.6
HEPPSO	7.85	7.1-8.5
Imidazole	6.95	6.2-7.8
MES	6.10	5.5-6.7
MOPS	7.14	6.5-7.9
MOPSO	6.87	6.2-7.6
Phosphate buffers	2.15	1.7-2.9
PIPES	6.76	6.1-7.5
POPSO	7.78	7.2-8.5
Potassium acetate	4.76	3.6-5.6
Pyridine	5.23	4.9-5.9
Sodium acetate	4.76	3.6-5.6
Sodium formiate	3.75	3.0-4.5
Succinate	4.21	3.2-5.2
TAPS	8.40	7.7-9.1
TAPSO	7.61	7.0-8.2
Taurine	9.06	8.4-9.6
TES	7.40	6.8-8.2
TRICINE	8.05	7.4-8.8
Triethanolamine	7.76	7.0-8.3
TRIS	8.06	7.5-9.0

Buffer Reagents (buffered pH range)	pK_a (25 °C)	pH range
Phosphate buffers	2.15	1.7-2.9
Glycine	2.35	2.2-3.6
Citrate	3.13	2.2-6.5
Glycyl-glycine	3.14	2.5-3.8
Sodium formiate	3.75	3.0-4.5
Succinate	4.21	3.2-5.2
Potassium acetate	4.76	3.6-5.6
Sodium acetate	4.76	3.6-5.6
Pyridine	5.23	4.9-5.9
Cacodylic acid	6.27	5.0-7.4
MES	6.10	5.5-6.7
BIS-TRIS	6.46	5.8-7.2
ADA	6.59	6.0-7.2
Carbonate buffers	6.35	6.0-8.0
ACES	6.78	6.1-7.5
PIPES	6.76	6.1-7.5
MOPSO	6.87	6.2-7.6
Imidazole	6.95	6.2-7.8
BIS-TRIS-Propane	6.80	6.3-9.5
BES	7.09	6.4-7.8
MOPS	7.14	6.5-7.9
HEPES	7.48	6.8-8.2
TES	7.40	6.8-8.2
DIPSO	7.52	7.0-8.2
TAPSO	7.61	7.0-8.2
Triethanolamine	7.76	7.0-8.3
HEPPSO	7.85	7.1-8.5
POPSO	7.78	7.2-8.5
TRICINE	8.05	7.4-8.8
TRIS	8.06	7.5-9.0
HEPPS, EPPS	8.00	7.6-8.6
BICIN	8.26	7.6-9.0
TAPS	8.40	7.7-9.1
AMPSO	9.00	8.3-9.7
Taurine	9.06	8.4-9.6
CHES	9.50	8.6-10.0
AMP	6.69	8.7-10.4
CAPSO	9.60	8.9-10.3
CAPS	10.40	9.7-11.1

GOOD'S BUFFERS FOR APPLICATIONS IN MOLECULAR BIOLOGY

In order to compensate for the low Tris buffering capacity at pH levels below 7.5, Good and colleagues 1966 developed a new reagent group as a buffer for this range: N-substituted amino sulphonic acids[1]. Amino sulphonic acids behave like strong hybrid ions at hysiological pH levels (approx. 7.0) and facilitate a large spectrum of molecular biological processes by virtue of their high buffering capacity.
The group of 'Good's buffers' also includes sulphonic acids and reagents such as bicine, tricine and AMP with higher pKa values, thus providing buffer substances for the entire pH range between 5.5 and 11..

[1]Good *et al.* (1966) *Biochemistry* 5:467-477.

Product	Buffer Reagent	pK_a (at 25 °C)	pH Range	Purity	Art. No.	Pack Qty.
ACES	N-(2-Acetamido)-2-aminoethanesulphonic acid	6,78	6,1-7,5	≥99 %	**9138.1**	10 g
					9138.2	100 g
AMP	2-Amino-2-methyl-1-propanol	6,69	8,7-10,4	≥90 %	**3121.1**	250 ml
AMPSO	3-N-(α,α-Dimethyl-hydroxyethyl)-amino-2-hydroxypropane sulphonic acid	9,00	8,3-9,7	≥98 %	**7159.1**	25 g
					7159.2	100 g
BES	N,N-Bis-(2-hydroxyethyl)-2-aminoethane sulphonic acid	7,09	6,4-7,8	≥99 %	**9134.1**	25 g
					9134.2	100 g
					9134.3	250 g
					9134.4	500 g
BICINE	N,N-Bis-(2-hydroxyethyl)-glycine	8,26	7,6-9,0	≥99 %	**9162.1**	50 g
					9162.2	250 g
					9162.3	500 g
CAPS	Cyclohexylamino propanesulphonic acid	10,40	9,7-11,1	≥99 %	**9168.1**	25 g
					9168.3	100 g
					9168.2	250 g
CAPSO	3-N-Cyclohexylamino-2-hydroxypropane sulphonic acid	9,60	8,9-10,3	≥98 %	**5584.3**	25 g
					5584.1	100 g
					5584.2	500 g
CHES	2-(Cyclohexylamino)-ethanesulphonic acid	9,50	8,6-10,0	≥99 %	**9166.1**	10 g
					9166.3	25 g
					9166.2	100 g
DIPSO	3-N-Bis(hydroxyethyl)-amino-2-hydroxypropane sulphonic acid	7,52	7,0-8,2	≥98 %	**7151.1**	25 g
HEPES	N-2-Hydroxyethyl piperazine-N'-2-ethane sulphonic acid	7,48	6,8-8,2	≥99,5 %, BioScience-Grade	**6763.1**	100 g
					6763.2	500 g
					6763.3	1 kg
MES	2-(N-Morpholino)-ethane sulphonic acid	6,10	5,5-6,7	≥99 %	**4256.2**	100 g
					4256.5	250 g
					4256.3	500 g
					4256.4	1 kg
MOPS	3-(N-Morpholino) propane sulphonic acid	7,14	6,5-7,9	≥99,5 %	**6979.2**	250 g
					6979.4	500 g
					6979.3	1 kg
					6979.5	2,5 kg
MOPSO	3-(N-Morpholino)-2-hydroxypropane sulphonic acid	6,87	6,2-7,6	≥98 %	**7117.1**	25 g
					7117.2	100 g
					7117.3	1 kg
PIPES	Piperazine-N,N'-bis-(2-ethanesulphonic acid)	6,76	6,1-7,5	≥99 %	**9156.1**	25 g
					9156.2	100 g
					9156.3	250 g
					9156.4	500 g
POPSO	Piperazine-N,N'-bis(2-hydroxypropane sulphonic acid)	7,78	7,2-8,5	≥99 %	**6632.1**	25 g
					6632.2	100 g
TAPS	N-Tris(hydroxymethyl)-methyl-3-amino-propane sulphonic acid	8,40	7,7-9,1	≥99 %	**6982.1**	10 g
					6982.2	100 g
					6982.3	250 g
					6982.4	500 g

Product	Buffer Reagent	pK_a (at 25 °C)	pH Range	Purity	Art. No.	Pack Qty.
TAPSO	3-N-Tris(hydroxymethyl)-methylamino-2-hydroxypropanesulphonic acid	7,61	7,0-8,2	≥99 %	**6628.1**	25 g
					6628.2	100 g
TES	N-[Tris-(hydroxymethyl)-methyl]-2-aminoethane sulphonic acid	7,40	6,8-8,2	≥99 %	**9137.1**	10 g
					9137.2	100 g
					9137.3	500 g
TRICINE	N-Tris-(hydroxymethyl)-methyl-glycine	8,05	7,4-8,8	≥99 %	**6977.1**	50 g
					6977.4	250 g
					6977.2	500 g
					6977.3	1 kg
					6977.5	2,5 kg

For additional product data and safety information, see chapter Chemicals A-Z.

TRIS BUFFERS

Tris (hydroxymethyl) aminomethane (or 'Tris' for short) was first described[1] in 1897 and then proposed as a pH-stabilising reagent for biological systems[2] in 1946. On account of its high water solubility, its very large buffering capacity and the fact that it behaves inertly in a large number of enzymatic reactions, it has been used for many years as a base reagent for standard buffers in all fields of molecular biology.

[1]Piloty *et* Ruff (1897) *Proc. Soc. Exp. Biol. Med.* 6:233-234.
[2]Gomori (1946) *Ber. Dtsch. Chem. Ges.* 30:1656-1665.

In addition to the original, alkaline Tris, the pre-buffered Tris hydrochloride (Tris-HCl) is also available today. 1 M Tris buffer can be manufactured directly with a defined pH buffering range through skilful mixing of Tris (alkaline) and Tris-HCl. The table below specifies the mixing ratio for each Tris.
Please note: the pH buffered by the Tris mixture depends heavily on the temperature.

The values found is the literature always refer to a temperature of 25 °C (unless specified otherwise).

Produkt	Pufferreagenz	pK_a (bei 25 °C)	pH-Bereich	Reinheit	Best.-Nr.
BIS-TRIS	Bis-(2-hydroxyethyl)-imino-tris-(hydroxymethyl)-methan	6,46	5,8-7,2	≥99 %	**9140.1**
					9140.2
					9140.3
BIS-TRIS-Propan	1,3-Bis(tris(hydroxymethyl)-methylaminopropan)	6,80	6,3-9,5	≥98 %	**6999.1**
					6999.2
TRIS	Tris-(hydroxymethyl)-aminomethan	8,06	7,5-9,0	≥99,9 %, p.a.	**4855.1**
					4855.2
					4855.5
					4855.3
					4855.4
TRIS Hydrochlorid	Tris-(hydroxymethyl)-aminomethanhydrochlorid, Tris-HCl	8,06	7,5-9,0	≥99 %, p.a.	**9090.1**
					9090.2
					9090.3
					9090.5
					9090.4

For additional product data and safety information, see chapter Chemicals A-Z.

Table for the production of 1 molar Tris-buffer pH 7.2-9.0

pH at:			for 1 litre 1 M-solution	
5 °C	25 °C	37 °C	Tris (g)	Tris-HCl (g)
7.76	7.20	6.91	13.4	140.4
7.89	7.30	7.02	16.0	137.0
7.97	7.40	7.12	19.4	132.2
8.07	7.50	7.22	23.6	127.0
8.18	7.60	7.30	27.8	121.2
8.26	7.70	7.40	33.2	114.4
8.37	7.80	7.52	39.4	106.4
8.48	7.90	7.62	46.0	97.6
8.58	8.00	7.71	53.0	88.8
8.68	8.10	7.80	59.4	80.4
8.78	8.20	7.91	66.8	70.8
8.88	8.30	8.01	74.0	61.4
8.98	8.40	8.10	80.6	52.8
9.09	8.50	8.22	87.2	44.2
9.18	8.60	8.31	93.0	36.6
9.28	8.70	8.42	98.0	30.0
9.36	8.80	8.51	102.6	24.6
9.47	8.90	8.62	106.4	19.2
9.56	9.00	8.70	109.4	15.2

Instructions:
Dissolve the stated amounts Tris plus Tris HCl in 1 l water end volume. You will receive a 1 molar Tris-solution with the stated pH-value. The pH-value of the solution should be rechecked. As Tris and Tris HCl are hygroscopic, they should be dried before weighing. This will increase accuracy.

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