

# Certificate

## Standard Reference Materials

### Potassium Dihydrogen Phosphate (186-I-c)

### Disodium Hydrogen Phosphate (186-II-c)

These standard reference materials are intended for use in defining the pH(S) scale. The lots of potassium dihydrogen phosphate ( $\text{KH}_2\text{PO}_4$ ) and disodium hydrogen phosphate ( $\text{Na}_2\text{HPO}_4$ ) were prepared to ensure high purity and uniformity. They meet the specifications of the American Chemical Society for reagent-grade materials, but should not be considered as entirely free from impurities such as traces of water, free acid or alkali, carbon dioxide, chlorides, sulfur compounds and heavy metals.

The pH(S) values listed below correspond to  $\log(1/a_{\text{H}})$ , where  $a_{\text{H}}$  is a conventional activity of the hydrogen (hydronium) ion referred to the standard state on the scale of molality. The values were derived from the emf of cells without liquid junction by the method of calculation described in the Journal of Research of the National Bureau of Standards, 66A, 179 (1962). The uncertainty of the assigned values of pH(S) is estimated not to exceed  $\pm 0.005$  unit from 0 to 50 °C. The values listed below apply only to the lots here certified. Minor variation of pH(S) (of the order of a few thousandths of a unit) may be expected to occur between different lots.

The solution 0.025 molal with respect to both  $\text{KH}_2\text{PO}_4$  and  $\text{Na}_2\text{HPO}_4$  is recommended for the calibration of pH equipment. The pH(S) of this solution as a function of temperature is given below:

°C	pH(S)	°C	pH(S)	°C	pH(S)
0	6.982	20	6.878	37	6.839
5	6.949	25	6.863	40	6.836
10	6.921	30	6.851	45	6.832
15	6.898	35	6.842	50	6.831

For pH measurements in the physiologically important range pH 7 to 8 a solution 0.008695 molal in  $\text{KH}_2\text{PO}_4$  and 0.03043 molal in  $\text{Na}_2\text{HPO}_4$  is also useful. The pH(S) values for this solution as a function of a temperature follow: [See Journal of Research of the National Bureau of Standards, 65A, 267 (1961).]

°C	pH(S)	°C	pH(S)	°C	pH(S)
0	7.534	20	7.430	37	7.392
5	7.501	25	7.415	40	7.388
10	7.472	30	7.403	45	7.385
15	7.449	35	7.394	50	7.384

The potassium dihydrogen phosphate was obtained from the Mallinkrodt Chemical Works of St. Louis, Missouri; the disodium hydrogen phosphate from the J. T. Baker Chemical Co., of Phillipsburg, New Jersey. The experimental work leading to the certification of this material was carried out by M. Paabo and B. R. Staples.

The overall direction and coordination of technical measurements leading to the certification were performed under the chairmanship of R. A. Durst.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by T. W. Mears.

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J. Paul Cali, Acting Chief  
Office of Standard Reference Materials

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### PREPARATION OF THE 0.025-MOLAL SOLUTION

Transfer 3.387 g of the potassium dihydrogen phosphate (186-I-c) and 3.533 g of the disodium hydrogen phosphate (186-II-c) to a 1-liter volumetric flask. Dissolve and fill to the mark with distilled water at 25 °C. The distilled water should not contain dissolved carbon dioxide and should have a conductivity no greater than  $2 \times 10^{-6}$  ohm<sup>-1</sup> cm<sup>-1</sup>. Carbon dioxide-free water can be prepared by boiling a good grade of distilled water for 10 minutes and guarding it with a soda-lime tube while cooling. The salts should be dried for 2 hours at 110 °C to 130 °C before use. Although elaborate precautions to prevent contamination of the buffer solution with atmospheric carbon dioxide are usually unnecessary, the container should be kept tightly stoppered at all times when a sample is not actually being removed. (The figures given are weights in air.)

The solution should be replaced after a few weeks or sooner if molds or sediment appear, or if it has been exposed repeatedly to air containing carbon dioxide.

### PREPARATION OF THE PHYSIOLOGICAL STANDARD SOLUTION

The physiological standard solution pH(S) = 7.415 at 25 °C, is prepared by transferring 1.179 g of potassium dihydrogen phosphate (186-I-c) and 4.303 g of disodium hydrogen phosphate (186-II-c) to a 1-liter volumetric flask, dissolving, and filling to the mark with water of the quality described above. (The figures given are weights in air.)

This buffer solution is more sensitive to contamination with carbon dioxide than is the 0.025-molal solution. If the solution is to maintain the assigned pH(S) for a few weeks, exclusion of carbon dioxide may be essential.