J. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards

Certificate

Standard Reference Materials

2191a Sodium Bicarbonate

2192a Sodium Carbonate

These Standard Reference Materials (SRM's) are intended for use in preparing buffer solutions to calibrate electrodes for pD measuring systems. The lots of sodium bicarbonate ($NaHCO_3$) and sodium carbonate (Na_2CO_3) were prepared to ensure high-purity and uniformity. They meet the specifications of the American Chemical Society for reagent-grade materials; however, they should not be considered to be entirely free from impurities such as traces of water, free alkali, silica, chlorides, sulfur compounds, and heavy metals.

pD(S) Values

The pD(S) values listed below correspond to log $(1/a_D)$, where a_D is a conventional activity of the deuterium 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 similar to that described in the Journal of Research of the National Bureau of Standards, 66A, 179 (1962). The uncertainty of the assigned values of pD(S) is estimated not to exceed ± 0.005 unit from 5 to 50 °C[a]. The certified values listed below apply *only* to these lots.

A buffer solution which is 0.025 molal with respect to both $NaHCO_3$ and Na_2CO_3 is recommended for the calibration of the glass electrode and pH meter used for pD measurements. The pD(S) of this solution as a function of temperature is given below:

°C	pD(S)	°C	pD(S)	°C	pD(S)
5.0	10.993	25.0	10.732	40.0	10.60[a]
10.0	10.917	30.0	10.684	45.0	10.57[a]
15.0	10.849	35.0	10.641	50.0	10.54[a]
20.0	10.787				

[a]Because of some uncertainty involved at high temperatures, the last three values are certified to only two decimal places. The estimated uncertainty is within ±0.01 unit for these temperatures.

The sodium bicarbonate and sodium carbonate were obtained from Mallinckrodt, Inc., St. Louis, Mo.

The analytical measurements leading to the certification of these materials were performed by Y.C. Wu and W.F. Koch, NBS Inorganic Analytical Research Division.

The overall direction and coordination of technical measurements leading to the certification were performed under the chairmanship of J.R. DeVoe, Chief, NBS Inorganic Analytical Research Division.

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 W.P. Reed and L.J. Powell.

Gaithersburg, MD 20899
November 15, 1984

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

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Directions for Use

Preparation of the 0.025-molal solution: Add 2.101 g of sodium bicarbonate (SRM 2191a) and 2.651 g of sodium carbonate (SRM 2192a) to 1000.0 g of deuterium oxide (weights in air) and mix thoroughly. If volumetric apparatus is to be used, transfer 2.321 g of sodium bicarbonate and 2.928 g of sodium carbonate (weights in air) to a 1-liter volumetric flask. Dissolve and fill to the mark with deuterium oxide at 25 °C. Mix thoroughly by shaking. The deuterium oxide should have an isotopic composition of at least 99 mole percent D_2O. It should not contain dissolved carbon dioxide or other gases, and should have a conductivity no greater than 2×10^{-6} siemens/cm. Carbon dioxide-free deuterium oxide may be obtained by boiling while passing dry nitrogen or argon gas through the solution. The sodium bicarbonate should not be dried by heating; the sodium carbonate should be dried for 2 hours at 275 °C before use. The buffer solution should be protected from air during storage and all transfers of the D_2O solution should be done in an inert atmosphere to avoid rapid isotope exchange. If the calibration process is completed within one hour, it is not necessary to exclude air from the working solution.

The buffer solution should be discarded after a few weeks, or sooner, if sediment appears or if it has been exposed repeatedly to air.