National Institute of Standards & Technology

Certificate

Standard Reference Materials

2191a Sodium Bicarbonate
2192a Sodium Carbonate

pD Standard

These Standard Reference Materials (SRMs) 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) which constitute this SRM 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. SRMs 2191a and 2192a are provided in units of 30 g each.

The certified 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 reference 1. The uncertainty of the assigned values of pD(s) is estimated not to exceed ± 0.005 pD unit from 5 to 35 °C, or ± 0.01* pD unit above 35 °C. The certified values listed below apply **only** to these lots of $NaHCO_3$ and Na_2CO_3.

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*
10.0	10.917	30.0	10.684	45.0	10.57*
15.0	10.849	35.0	10.641	50.0	10.54*
20.0	10.787				

* 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.

Source of Material: The sodium bicarbonate and sodium carbonate were obtained from Mallinckrodt, Inc., St. Louis, MO.

This Certificate has undergone editorial revision to reflect program and organizational changes at NIST and at the Department of Commerce. No attempt was made to reevaluate the certificate values or any technical data presented on this certificate.

Gaithersburg, MD 20899
February 18, 1994
(Revision of certificate dated 11-15-84)

Thomas E. Gills, Acting Chief
Standard Reference Materials Program

(over)

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

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

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by W.P. Reed and L.J. Powell. Revision of this certificate was coordinated through the Standard Reference Materials Program by J.C. Colbert.

Direction for Use

Drying Instructions: The sodium bicarbonate should not be dried by heating, the sodium carbonate should be dried for 2 h at 275 °C before use.

Preparation of the 0.025-molal solution: Add 2.101 g of sodium bicarbonate (SRM 2191a) and 2.651 g of properly dried sodium carbonate (SRM 2192a) to 1000.0 g of deuterium oxide (weight 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 (weight in air) to a 1-L 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 then 2×10^{-4} siemens/cm. Carbon dioxide-free deuterium oxide may be obtained by boiling while passing dry nitrogen or argon gas through the liquid. The D_2O buffer solution should be protected from air during storage and all transfers of the solution should be done in an inert atmosphere to avoid isotope exchange. If the calibration process is completed within 1 h, it is not necessary to exclude air from the working solution.

Stability of Prepared Solution: The D_2O buffer solution should be discarded after a few weeks, or sooner, if sediment appears or if it has been exposed repeatedly to air containing carbon dioxide.

NOTICE AND WARNINGS TO USER

Expiration of Certification: This certification will be valid for five years from the date of shipment from NIST. Periodic reanalysis of representative samples from this SRM will be performed and if significant changes are observed within the five year period, the purchaser will be notified by NIST. Please return the attached registration card to facilitate notification.

Stability and Storage of Crystalline SRMs 2191a and 2192a: SRMs 2191a and 2192a should be stored in their original bottles at room temperature. They should be tightly re-capped after use and protected from moisture and light.

REFERENCE

[1] Bates, R.G., Revised Standard Values for pH Measurements from 0 to 95 °C, J. Res. NBS, 66A, 179 (1962).