COMPONENTS:	EVALUATOR:
(1) Cesium Bromate; $CsBrO_3$; [13454-75-6]	H. Miyamoto Niigata University Niigata, Japan and M. Salomon US Army ET & DL Fort Monmouth, NJ, USA
(2) Water; H_2O; [7732-18-5]	February 1986

CRITICAL EVALUATION:

THE BINARY SYSTEM

Data for the solubility of cesium bromate in water have been reported in five publications (1-5). The compilations based on references (4, 5) are given in the chapters on $KBrO_3$ and $RbBrO_3$, respectively. The isothermal method was used in all studies, and in (3-5) the solid phase was determined to be the anhydrous salt. Buell and McCrosky (2) reported a melting point of 693 K for the pure salt. A summary of the experimental solubility data is given in Table 1. Solubilities in mol kg^{-1} units are given in the compilations.

Table 1. Summary of Experimental Solubilities[a]

T/K	mass %	χ	(ref)	T/K	mass %	χ	(ref)
273.2	1.17	0.000817	(3)	308.2	5.06[b,c]	0.003667	(2)
283.2	1.90	0.001336	(3)	313.2	6.28	0.004607	(3)
293.2	2.09[b]	0.001472	(3)	323.2	8.56	0.006425	(3)
298.2	3.75	0.002684	(3)	333.2	11.32	0.008740	(3)
298.2	3.54[b,c]	0.002527	(2)	343.2	14.48	0.011560	(3)
298.2	3.66	0.002617	(4)	353.2	17.99	0.014926	(3)
298.2	3.71	0.002654	(5)	363.2	22.01[b]	0.019121	(3)
303.2	4.34[b,c]	0.003121	(1,2)	373.2	25.96	0.023647	(3)
303.2	4.46	0.003214	(3)				

[a]Conversions to mole fraction units by evaluators.

[b]Rejected data points (see text for discussion).

[c]Original units are g/100 g H_2O, and conversion to mass % by evaluators.

Inspection of Table 1 shows that all data reported by Buell and McCrosky (1,2) are significantly lower than corresponding data from (3,4,5) by as much as 6%. All data reported in (1,2) were rejected. Breusov et al. (3) find that when log (χ) is plotted as a function of T/K, a break in the curve is observed at 300 K, and which is attributed to a change in hydration of ions in solution. However the evaluators plotted the simple function of mole fraction vs T/K, and we find a smooth monotonous curve in which only the data point at 293.2 K falls off the curve. In fitting the data to the smoothing equation, again it is found that the point at 293.2 K from (3) deviates significantly from the calculated value (for all data points in Table 1 except those from (1,2), we find that $\chi_{exptl} = 0.001472$ compared to the calculated value of $\chi = 0.002008$). Using our criteria that all acceptable data points should not be greater or less than $2\sigma_x$ from the smoothed calculated values, one more data point from (3) at 363.2 K was rejected. The final smoothing equation based on the 12 remaining data points based on mole fraction units is:

$$Y_x = -32233.93/(T/K) - 137.0375\ell n(T/K) + 825.2493 + 0.178260(T/K) \quad [1]$$

$$\sigma_y = 0.018 \qquad \sigma_x = 2.8 \times 10^{-5}$$

Based on the 12 acceptable data points, the derived smoothing equation based on mol kg^{-1} units is:

$$Y_m = -6754.46/(T/K) - 10.4410\ell n(T/K) + 82.116 \quad [2]$$

$$\sigma_y = 0.013 \qquad \sigma_m = 0.0067$$

Solubilities calculated from eqs. [1] and [2] are designated as *tentative* values, and calculated solubilities at rounded temperatures are given in Table 2.

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CRITICAL EVALUATION:

Table 2. Tentative Solubilities Calculated from Eqs. [1] and [2]. In all Cases the Solid Phase is Anhydrous $CsBrO_3$.

T/K	χ	m/mol kg^{-1}
273.2	0.000813	0.0457
283.2	0.001356	0.0752
293.2	0.002138	0.1181
298.2	0.002636	0.1457
303.2	0.003213	0.1779
308.2	0.003878	0.2153
313.2	0.004636	0.2582
323.2	0.006460	0.3624
333.2	0.008740	0.4937
343.2	0.01153	0.6545
353.2	0.01490	0.8466
363.2	0.01892	1.0709
373.2	0.02367	1.3274

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