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CONTRACTION OF AQUEOUS SOLUTIONS OF ACETONE.

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IN the following determinations, mixtures of known weights of acetone and water were made, the specific gravity determined by a piknometer and from this figure the volume calculated. The acetone used was bought from a New York firm and was of good purity, being free from methyl alcohol. It was fractionated and the fraction retained was boiled over calcium chlorid under a reflux condenser for three days. This portion was once more fractionated. The portion finally used boiled at 56.4° (air). Other samples were prepared for comparison by distilling acetates and by purifying the New York article by means of the sulphite compound. These various preparations possessed essentially the same boiling points and specific gravity.

In detail the method employed was to weigh a flask, add water, weigh, add acetone, reweigh, mix the united fluids by shaking and finally determine the specific gravity, first at 20° and then without refilling the piknometer, at 25°. The figures thus obtained are given in the annexed table:

TABLE I.

Weight acetone. Grams.	Weight water. Grams.	Acetone. Per cent.	Water. Per cent.	Total weight. Grams.	Specific gravity 20°.	Specific gravity 25°.
39.7256	2.0878	95.01	4.99	41.8134	0.80717	0.80174
37.4627	4.1328	90.09	9.91	41.5955	0.82172	0.81626
33.4936	4.6211	87.88	12.12	38.1147	0.82784	0.82278
32.3374	8.0688	80.04	19.96	40.4062	0.84972	0.84443
30.1632	10.0480	75.02	24.98	40.2112	0.86342	0.85796
28.1373	12.0375	70.04	29.96	40.1748	0.87495	0.87051
24.2140	16.1070	60.06	39.94	40.3210	0.89920	0.89469
20.1621	20.0854	50.10	49.90	40.2475	0.92078	0.91656
16.1438	24.1902	40.03	59.97	40.3360	0.94057	0.93695
12.5495	28.1583	30.83	69.17	40.7078	0.95606	0.95286
8.0333	32.8027	19.67	80.33	40.8360	0.97270	0.97024
4.0120	36.0740	10.01	89.99	40.0860	0.98507	0.98337

In table II these weights are recalculated into volumes at 20° and the per cent. of contraction for that temperature calculated. The figures representing the weights of the acetone were divided by the specific gravity of acetone at 20° (0.79197) and the volume

occupied at that temperature thus found. The same operation performed on the weight of the water, using the figure 0.99826, gave the volume of that liquid. These two volumes added together gave the figures recorded in the fifth column under "sum". The weight of the mixed acetone and water divided by the specific gravity at 20° gave the actual volume occupied by the mixture at that temperature. The difference between this figure and that representing the sum of the volumes of the unmixed liquids, when divided by the latter figure gave the "Per cent. of Contraction," the figure recorded in the last column.

TABLE II. VOLUME AT 20°.

Acetone. Per cent.	Water. Per cent.	Acetone. Cubic centimeter.	Water. Cubic centimeter.	Sum. Cubic centimeter.	Actual volume.	Contraction. Per cent.
95.01	4.99	50.161	2.091	52.252	51.802	0.861
90.09	9.91	47.303	4.140	51.443	50.620	1.600
87.88	12.12	42.291	4.629	46.920	46.041	1.873
80.04	19.96	40.831	8.083	48.914	47.552	2.784
75.02	24.98	38.086	10.065	48.151	46.572	3.279
70.04	29.96	35.528	12.058	47.586	45.919	3.503
60.06	39.94	30.574	16.135	46.709	44.840	4.002
50.10	49.90	25.458	20.120	45.578	43.710	4.089
40.03	59.97	20.384	24.232	44.616	42.885	3.880
30.83	69.17	15.845	28.207	44.052	42.579	3.344
19.67	80.33	10.143	32.860	43.003	41.982	2.374
10.01	89.99	5.066	36.137	41.203	40.694	1.236

The weights, recalculated in the same way but using the specific gravities of water and acetone at 25°, which are respectively 0.78630 and 0.99712, are recorded in the following table:

TABLE III. VOLUME AT 25°

Acetone. Per cent.	Water. Per cent.	Acetone. Cubic centimeter.	Water. Cubic centimeter.	Sum. Cubic centimeter.	Actual volume.	Contraction. Per cent.
95.01	4.99	50.522	2.094	52.616	52.153	0.880
90.09	9.91	47.644	4.144	51.788	50.958	1.603
87.88	12.12	42.596	4.634	47.230	46.324	1.918
80.04	19.96	41.126	8.092	49.210	47.850	2.779
75.02	24.98	38.361	10.077	48.430	46.858	3.241
70.04	29.96	35.784	12.072	47.856	46.151	3.561
60.06	39.94	30.795	16.153	46.948	45.067	4.006
50.10	49.90	25.642	20.143	45.785	43.911	4.093
40.03	59.97	20.531	24.260	44.791	43.050	3.889
30.83	69.17	15.960	28.240	44.200	42.722	3.344
19.67	80.33	10.217	32.897	43.114	42.090	2.374
10.01	89.99	5.102	36.180	41.282	40.764	1.255

Taking the figures in Tables II and III and calculating the contractions for every five per cent. by simple interpolation the following table is obtained:

TABLE IV.

Water.	Acetone.	Contraction at 20°.	Contraction at 25°.	Water.	Acetone.	Contraction at 20°.	Contraction at 25°.
0.00	100.00	0.000	0.000	49.90	50.10	4.089	4.093
4.99	95.01	0.861	0.880	50.00	50.00	4.087	4.091
5.00	95.00	0.863	0.882	55.00	45.00	3.983	3.987
9.91	90.09	1.600	1.603	59.97	40.03	3.880	3.889
10.00	90.00	1.611	1.616	60.00	40.00	3.876	3.887
12.12	87.88	1.873	1.918	65.00	35.00	3.589	3.632
15.00	85.00	2.208	2.234	69.17	30.83	3.334	3.334
19.96	80.04	2.784	2.779	70.00	30.00	3.272	3.272
20.00	80.00	2.789	2.783	75.00	25.00	2.838	2.837
24.98	75.02	3.279	3.241	80.00	20.00	2.403	2.403
25.00	75.00	3.280	3.242	80.33	19.67	2.374	2.374
29.96	70.04	3.503	3.561	85.00	15.00	1.824	1.833
30.00	70.00	3.505	3.563	89.99	10.01	1.236	1.255
35.00	65.00	3.753	3.787	90.00	10.00	1.235	1.254
39.94	60.06	4.002	4.006	95.00	5.00	0.619	0.627
40.00	60.00	4.003	4.007	100.00	0.00	0.000	0.000
45.00	55.00	4.046	4.050	.....	....	....	....

It was originally intended to make a determination for every five per cent. increase in the amount of acetone in the mixtures, but owing to an accident, a portion of the purified acetone was lost and from seventy per cent. acetone down, the determinations were made for each ten per cent. It will be noticed by an inspection of the table that the two series of figures, those for 20° and those for 25°, do not vary materially from each other, showing that between these temperatures the contractions of mixtures of the two liquids are practically the same. The contraction appears to reach its maximum where the weights of acetone and water employed are equal, but there is no great difference between a forty per cent. mixture and one with sixty.