

XVI. *On the Value in Absolute Alcohol of Spirits of different Specific Gravities.*By GEORGE FOWNES, *Esq.*, *F.R.S.*,*Professor of Practical Chemistry in University College, London.*

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HAVING been for some months past occupied with experiments on the fermentation of sugar and molasses, and having found it necessary to construct for this purpose a new table of the quantity per centum by weight of absolute alcohol contained in spirits of different specific gravities, I venture to lay the same before the Royal Society, hoping that it may be found generally useful in inquiries of this kind, and also for other purposes.

The Table was formed synthetically; absolute alcohol and distilled water were weighed out in the required proportions, mixed in small well-stopped bottles and well-shaken together. After standing three or four days the mixtures were brought to the temperature of 60° FAHR. exactly, and their specific gravities determined with great care. After the lapse of two or three days more this last-named operation was repeated, but in no case was it observed that any further contraction had occurred. Neither was the specific gravity of a mixture containing nearly equal parts alcohol and water which had been so examined changed by being inclosed in a strong accurately-stoppered bottle, and heated for some time to a temperature above its boiling-point.

In this manner each alternate number in the Table (each even number) was obtained by direct experiment; the others were then interpolated. When completed, the Table was examined by various methods calculated to test its accuracy, but no error of sufficient magnitude to limit its usefulness was detected.

The absolute alcohol employed in these experiments was prepared in the following manner:—the strongest rectified spirit was agitated with half its weight of carbonate of potash deprived of water of crystallization, and left in contact with the salt some days. It was then decanted upon half its weight of powdered quicklime, made from black marble, contained in a metal still which could be perfectly closed. The mixture of spirit and lime was retained in a warm situation for a week or thereabouts, and then distilled by means of a water-bath. By this treatment the specific gravity of the alcohol was generally reduced to .796 or even below, and by a repetition of the process of digestion with powdered lime and re-distillation, the last traces of water were removed. In this manner, without difficulty, the very considerable quantity of absolute alcohol required for the experiments was procured.

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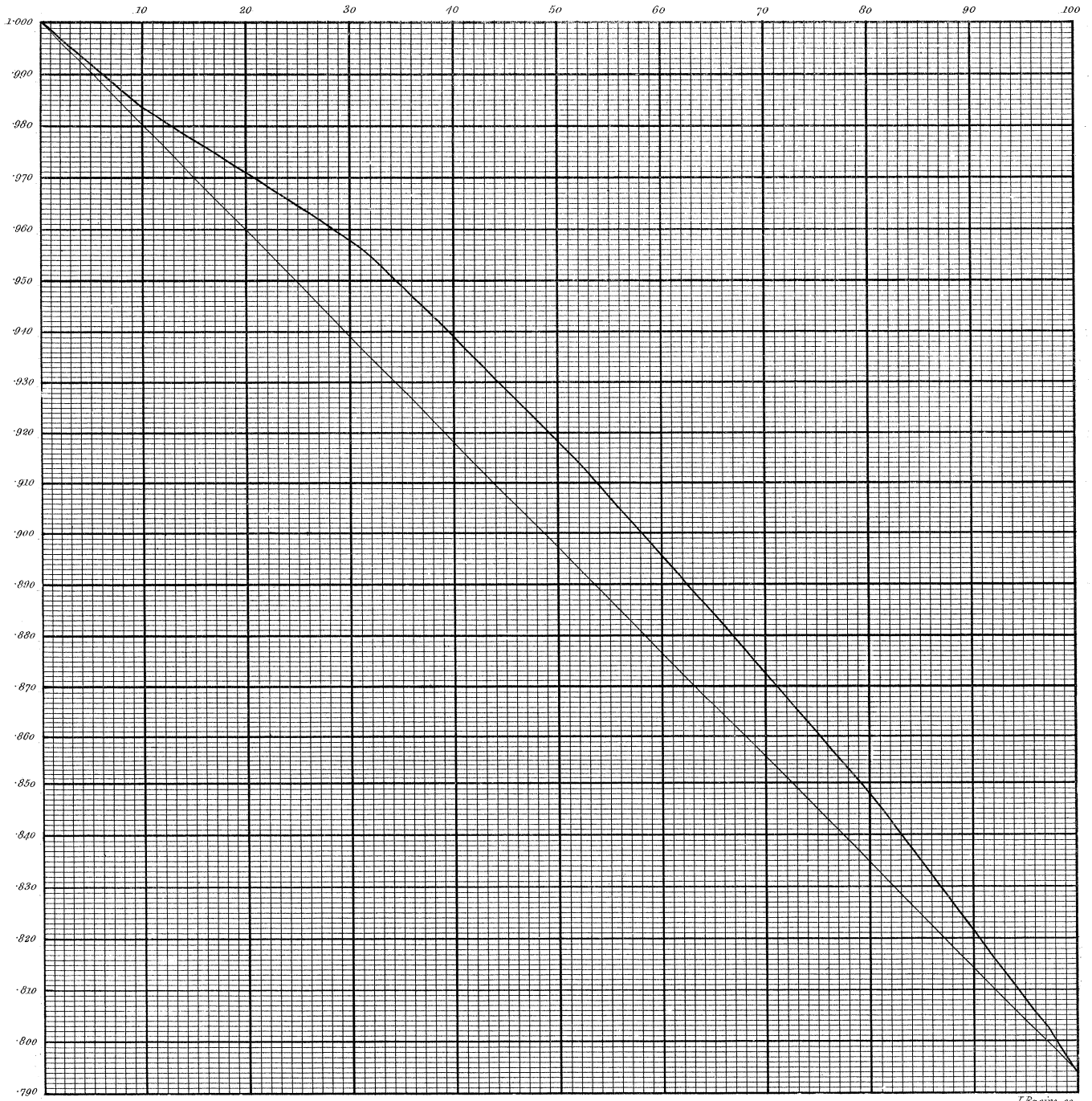
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Absolute alcohol thus obtained has the specific gravity $\cdot 7938$ at 60° FAHR.; it is extremely expansible by heat, which renders the determination of its exact specific gravity difficult and troublesome when the temperature of the room is either above or below 60° . The same remark applies to the mixtures of alcohol and water extending over more than half the Table, the most minute precautions regarding temperature being necessary to avoid serious errors. In a glass retort containing pieces of copper-foil absolute alcohol boils at 177° FAHR., the barometer standing at $29\cdot 75$ inches. Lastly, when analysed by combustion with oxide of copper, it yields numbers representing the proportions of carbon and hydrogen present so closely agreeing with those required by theory, as to leave no doubt of its purity and freedom from all admixture.

The contraction of volume suffered by various mixtures of alcohol and water may be rendered obvious by comparing the actual specific gravities of such mixtures with the calculated mean specific gravities. In the accompanying Plate (XIII.), in which the vertical lines represent the per-centage of alcohol by weight, and the horizontal lines the specific gravities, the calculated mean specific gravities of the mixtures are seen to form a straight diagonal line from corner to corner, while the actual specific gravities form an irregular curve with upward convexity, rising quickly to near its maximum deviation at 30 per cent., running nearly parallel with the other line to 50 per cent., and thence declining until it reaches the extremity of the scale.

University College,
June 7th, 1847.

Comparison of mean and actual specific gravities of various mixtures of alcohol and water.



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Table of the proportion by weight of real or absolute alcohol contained in 100 parts of spirits of different specific gravities at the temperature of 60° FAHR.

Specific gravity.	Per-centage of alcohol.	Specific gravity.	Per-centage of alcohol.	Specific gravity.	Per-centage of alcohol.
·9991	0·5	·9511	34	·8769	68
·9981	1	·9490	35	·8745	69
·9965	2	·9470	36	·8721	70
·9947	3	·9452	37	·8696	71
·9930	4	·9434	38	·8672	72
·9914	5	·9416	39	·8649	73
·9898	6	·9396	40	·8625	74
·9884	7	·9376	41	·8603	75
·9869	8	·9356	42	·8581	76
·9855	9	·9335	43	·8557	77
·9841	10	·9314	44	·8533	78
·9828	11	·9292	45	·8508	79
·9815	12	·9270	46	·8483	80
·9802	13	·9249	47	·8459	81
·9789	14	·9228	48	·8434	82
·9778	15	·9206	49	·8408	83
·9766	16	·9184	50	·8382	84
·9753	17	·9160	51	·8357	85
·9741	18	·9135	52	·8331	86
·9728	19	·9113	53	·8305	87
·9716	20	·9090	54	·8279	88
·9704	21	·9069	55	·8254	89
·9691	22	·9047	56	·8228	90
·9678	23	·9025	57	·8199	91
·9665	24	·9001	58	·8172	92
·9652	25	·8979	59	·8145	93
·9638	26	·8956	60	·8118	94
·9623	27	·8932	61	·8089	95
·9609	28	·8908	62	·8061	96
·9593	29	·8886	63	·8031	97
·9578	30	·8863	64	·8001	98
·9560	31	·8840	65	·7969	99
·9544	32	·8816	66	·7938	100
·9528	33	·8793	67		