TABLE *for converting Degrees of the Fahrenheit Thermometer to Degrees of Centigrade.*

Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.
32°	0°	69°	20°.555	106°	41°.111	143°	61°.666	180°	82°.222
33	0.555	70	21.111	107	41.666	144	62.222	181	82.777
34	1.111	71	21.666	108	42.222	145	62.777	182	83.333
35	1.666	72	22.222	109	42.777	146	63.333	183	83.888
36	2.222	73	22.777	110	43.333	147	63.888	184	84.444
37	2.777	74	23.333	111	43.888	148	64.444	185	85.000
38	3.333	75	23.888	112	44.444	149	65.000	186	85.555
39	3.888	76	24.444	113	45.000	150	65.555	187	86.111
40	4.444	77	25.000	114	45.555	151	66.111	188	86.666
41	5.000	78	25.555	115	46.111	152	66.666	189	87.222
42	5.555	79	26.111	116	46.666	153	67.222	190	87.777
43	6.111	80	26.666	117	47.222	154	67.777	191	88.333
44	6.666	81	27.222	118	47.777	155	68.333	192	88.888
45	7.222	82	27.777	119	48.333	156	68.888	193	89.444
46	7.777	83	28.333	120	48.888	157	69.444	194	90.000
47	8.333	84	28.888	121	49.444	158	70.000	195	90.555
48	8.888	85	29.444	122	50.000	159	70.555	196	91.111
49	9.444	86	30.000	123	50.555	160	71.111	197	91.666
50	10.000	87	30.555	124	51.111	161	71.666	198	92.222
51	10.555	88	31.111	125	51.666	162	72.222	199	92.777
52	11.111	89	31.666	126	52.222	163	72.777	200	93.333
53	11.666	90	32.222	127	52.777	164	73.333	201	93.888
54	12.222	91	32.777	128	53.333	165	73.888	202	94.444
55	12.777	92	33.333	129	53.888	166	74.444	203	95.000
56	13.333	93	33.888	130	54.444	167	75.000	204	95.555
57	13.888	94	34.444	131	55.000	168	75.555	205	96.111
58	14.444	95	35.000	132	55.555	169	76.111	206	96.666
59	15.000	96	35.555	133	56.111	170	76.666	207	97.222
60	15.555	97	36.111	134	56.666	171	77.222	208	97.777
61	16.111	98	36.666	135	57.222	172	77.777	209	98.333
62	16.666	99	37.222	136	57.777	173	78.333	210	98.888
63	17.222	100	37.777	137	58.333	174	78.888	211	99.444
64	17.777	101	38.333	138	58.888	175	79.444	212	100.000
65	18.333	102	38.888	139	59.444	176	80.000		
66	18.888	103	39.444	140	60.000	177	80.555		
67	19.444	104	40.000	141	60.555	178	81.111		
68	20.000	105	40.555	142	61.111	179	81.666		

TABLE *for converting Degrees of Centigrade Thermometer to Degrees of Fahrenheit.*

Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.	Centigrade.	Fahrenheit.
0°	32°	17°	62°.6	34°	93°.2	51°	123°.8	68°	154°.4	85°	185°.0
1	33.8	18	64.4	35	95.0	52	125.6	69	156.2	86	186.8
2	35.6	19	66.2	36	96.8	53	127.4	70	158.0	87	188.6
3	37.4	20	68.0	37	98.6	54	129.2	71	159.8	88	190.4
4	39.2	21	69.8	38	100.4	55	131.0	72	161.6	89	192.2
5	41.0	22	71.6	39	102.2	56	132.8	73	163.4	90	194.0
6	42.8	23	73.4	40	104.0	57	134.6	74	165.2	91	195.8
7	44.6	24	75.2	41	105.8	58	136.4	75	167.0	92	197.6
8	46.4	25	77.0	42	107.6	59	138.2	76	168.8	93	199.4
9	48.2	26	78.8	43	109.4	60	140.0	77	170.6	94	201.2
10	50.0	27	80.6	44	111.2	61	141.8	78	172.4	95	203.0
11	51.8	28	82.4	45	113.0	62	143.6	79	174.2	96	204.8
12	53.6	29	84.2	46	114.8	63	145.4	80	176.0	97	206.6
13	55.4	30	86.0	47	116.6	64	147.2	81	177.8	98	208.4
14	57.2	31	87.8	48	118.4	65	149.0	82	179.6	99	210.2
15	59.0	32	89.6	49	120.2	66	150.8	83	181.4	100	212.0
16	60.8	33	91.4	50	122.0	67	152.6	84	183.2		

Hydrometer, Alcoholometer, Areometer.

The areometer is an instrument whose construction depends on the philosophical principle that any body floating in a liquid displaces a volume of that liquid equal in weight to its own, from which it appears, on applying this principle to the instrument in question, it will sink deeper in a liquid of little specific gravity, and not so deep in a denser liquid or one of greater specific gravity.

There are two instruments alike in conformation, but differing only in the character of the liquids to which they are applicable, and bearing special names, indicative of the special liquids for the testing of which they are intended: one used for liquids heavier than pure water, as concentrated acids, saline solutions, syrups, must, either natural or artificial, &c., called *acidimeter saccharometer*, &c.; the other, which is employed for ascertaining the density of liquids lighter than water, as wines, spirits, alcohols, ethers, &c., is called *alcoholometer*, &c. A single areometer, with a

stem long enough, might answer for all cases; but the inconvenience inseparable from too long a stem, more than counterbalances its advantages. The areometers in general use, consist of a graduated glass tube, with an elongated bulb, containing a weight at the inferior extremity; they are, however, sometimes made of metal.

It must be observed that the degrees given by the areometer are only true when the liquid under examination is at the same temperature as the instrument when it was graduated.

One other point to be observed, is that the true level which is to be considered, is the ideal extension of the surface of the liquid under examination, and not the point marked on the stem by the summit of the curve caused by the capillarity of the stem of the instrument.

The areometer of Baumé is generally the only one used for liquids heavier than water. We shall speak of it more fully under the subject of syrups, and may dispense with any further notice of it here.

The *densimeter* is designed to replace the areometer of Baumé; it is the only one sanctioned by the adminstration of the assize for use in sugar refineries and distilleries. This instrument, placed in a liquid, indicates its density; that is to say, its weight in kilogrammes for a litre of the liquid.

For example: for a liquid, the density of which will be double that of water, the weight of the litre being two kilogrammes, one kilogramme of this liquid would only occupy the volume of half a litre; consequently, the indication by the densimeter would be 2.

The difference between the indications by the densimeter in saccharine liquids and syrups, will be proportional to the quantity per cent. in sugar or saccharine matter contained in the syrup, and as many kilogrammes of sugar should be counted in the hundred kilogrammes of syrup as there are degrees above 100.

There are a number of alcoholometers; those of Baumé, of Cartier, and of Gay Lussac, are the principal. The last is the simplest, in some respects, and will be more particularly described.

Centesimal Alcoholometer of Gay Lussac.

Gay Lussac, in 1824, invented an instrument resembling the ordinary areometer in form, to which he gave the name *centesimal alcoholometer*. When this instrument is plunged into a spirituous liquid, at the temperature of fifteen degrees, it at once indicates the *strength;* that is, the real volume of pure alcohol which it contains. His scale is divided into 100 parts or degrees, of which each represents a hundredth of anhydrous alcohol. The mark zero (0°) corresponds to pure water, and that for 100° to absolute alcohol. The instrument is graduated at a temperature of 15° in spirits supposed to be of the same temperature; if, for example, the alcoholometer of Gay Lussac sinks to the division 50°, it indicates that the strength of the spirit is fifty hundredths; in other words, that it consists of equal volumes of pure alcohol and water. In a liquor in which it floats at 90°, it will indicate a strength of ninety hundredths. The degrees of the alcoholometer indicating, as they do, the hundredths of alcohol, are called *centesimal degrees.*

Thus, according to the principles on which the centesimal alcoholometer is graduated, the strength of a spirituous liquid is the number of hundredths (in volume) of pure alcohol which this liquid contains at 15° Centigrade; from which it follows, that the real quantity of alcohol contained in a liquor, can always be ascertained readily and immediately, by multiplying the number which expresses the volume of the liquid by the number indicating its strength; which is seen by the greater or less immersion of the instrument in the liquor. Let us suppose, for example, a cask of 345 litres of brandy, the strength of which is 58 centesimal degrees, at the temperature of 15° Centigrade, that is to say, 58 per cent. of pure alcohol.

The following result:

	345
	58
	27.60
	172.5
	200.10

will indicate that the cask contains 200.10 litres of pure alcohol.

If the spirituous liquor should not be at the temperature of 15° Centigrade, it should be brought to this degree by heating it with the hand, or cooling it by placing the test glass in cold water; but it will be always more convenient in practice, to use the annexed table for ascertaining the actual strength of liquors at any given temperature.

Explanation of the Use of the Table Indicating the Actual Strength of Spirituous Liquors at any Given Temperature.

The centesimal alcoholometer, on which is based the collection of taxes, was graduated, as we have said, at the temperature of 15° Centigrade (12° Reaumer, 59° Fahrenheit). If the experiment be conducted at a higher temperature, the density of the liquid being diminished by expansion, the alcoholometer will sink deeper, and will indicate a greater degree of strength than at the legal temperature of 15°. The opposite will happen if the experiment be tried at a lower degree; it is, therefore, important, in the event that we cannot select or regulate the temperature, that we should be able to ascertain the true alcoholic degree of spirituous liquors to serve as a basis, either for the collection of duties, or to govern commercial transactions.

The following table supplies the means. It consists of two parts. The first indicates what are called degrees of *cold*; that is, those which are below 15°, and the second the degrees of *heat*, or those which are above 15° up to the temperature 30° of the Centigrade thermometer. The first column indicates the degree marked on the centesimal alcoholometer when plunged into a spirituous liquor, the following columns indicate its true degree for the temperature at the head of each column. Thus when the alcoholometer sinks to 49°, and the thermometer plunged into the same liquid indicates a temperature of 8°, we see that the true degree is 51.6. The same degree, if we make the experiment at a temperature of 24° with the same thermometer, would be only 45.6.

The areometer of Cartier being still used in some cities in the south and middle of France, we have thought it best to exhibit its relation to the centesimal alcoholometer, in connection with the tables indicating the true alcoholic strength of liquids.

TABLE *indicating the Actual Strength of Spirituous Liquors.*

Centesimal degrees.	DEGREES OF COLD.															
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
1	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.2	1.2	1.1	1.0
2	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.3	2.2	2.1	2.0
3	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.5	3.4	3.4	3.3	3.2	3.1	3.0
4	4.6	4.6	4.6	4.6	4.6	4.5	4.5	4.5	4.5	4.5	4.5	4.4	4.3	4.2	4.1	4.0
	5.6	5.6	5.6	5.6	5.6	5.5	5.5	5.5	5.5	5.5	5.5	5.4	5.3	5.2	5.1	5.0
6	6.7	6.9	6.7	6.7	6.7	6.6	6.6	6.6	6.6	6.6	6.5	6.4	6.3	6.2	6.1	6.0
7	7.8	7.8	7.8	7.8	7.8	7.7	7.7	7.7	7.7	7.7	7.5	7.4	7.3	7.2	7.1	7.0
8	8.8	8.8	8.8	8.8	8.8	8.7	8.7	8.7	8.7	8.7	8.5	8.4	8.3	8.2	8.1	8.0
9	9.9	9.9	9.9	9.9	9.9	9.8	9.8	9.8	9.8	9.8	9.5	9.4	9.3	9.2	9.1	9.0
10	11.0	11.0	11.0	11.0	11.0	10.9	10.9	10.9	10.9	10.9	10.6	10.5	10.4	10.3	10.2	10.0
11	12.2	12.2	12.2	12.2	12.2	12.1	12.1	12.1	12.1	12.1	11.7	11.6	11.5	11.5	11.2	11.0
12	13.4	13.4	13.4	13.3	13.3	13.2	13.1	13.0	13.0	12.9	12.7	12.6	12.5	12.4	12.2	12.0
13	14.7	14.7	14.7	14.6	14.5	14.4	14.3	14.2	14.1	14.0	13.8	13.6	13.5	13.4	13.2	13.0
14	16.1	16.0	16.0	15.9	15.8	15.7	15.6	15.4	15.3	15.1	14.9	14.7	14.6	14.4	14.2	14.0
15	17.5	17.3	17.2	17.1	16.9	16.8	16.7	16.6	16.4	16.2	16.0	15.8	15.6	15.4	15.2	15.0
16	18.9	18.7	18.5	18.3	18.1	18.0	17.8	17.7	17.5	17.3	17.0	16.8	16.6	16.4	16.2	16.0
17	20.3	20.0	19.8	19.6	19.4	19.2	19.0	18.8	18.6	18.4	18.1	17.9	17.6	17.4	17.2	17.0
18	21.6	21.3	21.1	20.8	20.6	20.4	20.2	20.0	19.7	19.5	19.2	19.0	18.7	18.5	18.2	18.0
19	22.9	22.6	22.3	22.0	21.8	21.5	21.3	21.0	20.7	20.5	20.2	20.0	19.7	19.5	19.2	19.0
20	24.2	23.9	23.6	23.3	23.0	22.7	22.4	22.1	21.8	21.6	21.3	21.0	20.7	20.5	20.2	20.0
21	25.6	25.3	24.9	24.6	24.3	24.0	23.6	23.3	23.0	22.7	22.4	22.1	21.8	21.5	21.2	21.0
22	27.0	26.7	26.3	25.9	25.6	25.2	24.9	24.6	24.2	23.9	23.5	23.2	22.9	22.6	22.3	22.0
23	28.4	28.0	27.5	27.1	26.8	26.4	26.0	25.7	25.3	25.0	24.6	24.3	24.0	23.6	23.3	23.0
24	29.7	29.2	28.8	28.4	28.0	27.6	27.2	26.9	26.5	26.1	25.7	25.4	25.1	24.7	24.3	24.0
25	30.9	30.4	30.0	29.6	29.2	28.8	28.4	28.0	27.6	27.2	26.8	26.5	26.1	25.7	25.3	25.0

TABLE *indicating the Actual Strength of Spirituous Liquors.*

Centesimal degrees.	DEGREES OF COLD.															
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
26	32.1	31.6	31.2	30.8	30.4	30.0	29.6	29.2	28.8	28.4	27.9	27.6	27.2	26.8	26.4	26.0
27	33.2	32.7	32.3	31.9	31.4	31.0	30.6	30.2	29.8	29.4	29.0	28.6	28.2	27.8	27.4	27.0
28	34.3	33.8	33.3	32.9	32.5	32.1	31.6	31.2	30.8	30.4	30.0	29.6	29.2	28.8	28.4	28.0
29	35.3	34.8	34.4	33.9	33.5	33.1	32.6	32.2	31.8	31.4	31.0	30.6	30.2	29.8	29.4	29.0
30	36.3	35.8	35.4	34.9	34.5	34.1	33.6	33.2	32.8	32.4	32.0	31.6	31.2	30.8	30.4	30.0
31	37.3	36.8	36.4	36.0	35.5	35.1	34.7	34.2	33.8	33.4	33.0	32.6	32.2	31.8	31.4	31.0
32	38.3	37.8	37.4	37.0	36.5	36.1	35.7	35.2	34.8	34.4	34.0	33.6	33.2	32.8	32.4	32.0
33	39.2	38.8	38.4	38.0	37.5	37.1	36.7	36.2	35.8	35.4	35.0	34.6	34.2	33.8	33.4	33.0
34	40.2	39.8	39.4	39.0	38.5	38.1	37.7	37.2	36.8	36.4	36.0	35.6	35.2	34.8	34.4	34.0
35	41.1	40.8	40.4	40.0	39.5	39.1	38.7	38.2	37.8	37.4	37.0	36.6	36.2	35.8	35.4	35.0
36	42.1	41.8	41.4	41.0	40.5	40.1	39.7	39.2	38.8	38.4	38.0	37.6	37.2	36.8	36.4	36.0
37	43.1	42.7	42.3	42.0	41.5	41.1	40.7	40.2	39.8	39.4	39.0	38.6	38.2	37.8	37.4	37.0
38	44.0	43.7	43.3	42.9	42.5	42.1	41.6	41.2	40.8	40.4	40.0	39.6	39.2	38.8	38.4	38.0
39	45.0	44.6	44.2	43.9	43.5	43.1	42.6	42.2	41.8	41.4	41.0	40.6	40.2	39.8	39.4	39.0
40	45.9	45.5	45.1	44.8	44.4	44.0	43.6	43.2	42.8	42.4	42.0	41.6	41.2	40.8	40.4	40.0
41	46.9	46.5	46.1	45.8	45.4	45.0	44.6	44.2	43.8	43.4	43.0	42.6	42.2	41.8	41.4	41.0
42	47.9	47.5	47.1	46.7	46.4	45.9	45.5	45.1	44.8	44.4	44.0	43.6	43.2	42.8	42.4	42.0
43	48.8	48.4	48.1	47.7	47.4	46.9	46.5	46.1	45.8	45.4	45.0	44.6	44.2	43.8	43.4	43.0
44	49.8	49.4	49.0	48.6	48.3	47.9	47.5	47.1	46.8	46.4	46.0	45.6	45.2	44.8	44.4	44.0
45	50.7	50.3	49.9	49.6	49.2	48.8	48.4	48.1	47.7	47.3	46.9	46.6	46.2	45.8	45.4	45.0
46	51.7	51.3	50.9	50.5	50.2	49.8	49.4	49.1	48.7	48.3	47.9	47.6	47.2	46.8	46.4	46.0
47	52.6	52.2	51.8	51.5	51.1	50.7	50.4	50.1	49.7	49.3	48.9	48.6	48.2	47.8	47.4	47.0
48	53.5	53.2	52.8	52.4	52.1	51.7	51.4	51.0	50.6	50.2	49.9	49.5	49.2	48.8	48.4	48.0
49	54.5	54.2	53.8	53.4	53.0	52.7	52.4	52.0	51.6	51.2	50.9	50.5	50.2	49.8	49.4	49.0
50	55.4	55.1	54.7	54.3	54.0	53.6	53.3	52.9	52.6	52.2	51.8	51.5	51.1	50.8	50.4	50.0

TABLE *indicating the Actual Strength of Spirituous Liquors.*

Centesimal degrees.	DEGREES OF COLD.															
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
51	56.4	56.0	55.7	55.3	55.0	54.6	54.3	53.9	53.6	53.2	52.8	52.5	52.1	51.8	51.4	51.0
52	57.3	57.0	56.6	56.3	56.0	55.6	55.2	54.9	54.6	54.2	53.8	53.5	53.1	52.7	52.3	52.0
53	58.3	57.9	57.6	57.2	56.9	56.6	56.2	55.9	55.5	55.1	54.8	54.4	54.1	53.7	53.3	53.0
54	59.2	58.9	58.5	58.2	57.9	57.5	57.1	56.8	56.5	56.1	55.8	55.4	55.0	54.7	54.3	54.0
55	60.2	59.9	59.5	59.2	58.9	58.5	58 1	57.8	57.5	57.1	56.8	56.4	56.0	55.7	55.3	55.0
56	61.2	60.9	60.5	60.2	59.8	59.5	59.1	58.8	58.5	58.1	57.8	57.4	57.0	56.7	56.3	56.0
57	62.1	61.8	61.5	61.1	60.8	60.4	60.1	59.8	59.5	59.1	58.8	58.4	58.0	57.7	57.3	57.0
58	63.1	62.8	62.4	62 1	61.7	61.4	61.0	60.7	60.4	60.0	59.7	59.4	59.0	58.7	58.3	58.0
59	64.1	63.8	63.4	63.1	62.7	62.4	62.0	61.7	61.4	61.0	60.7	60.4	60.0	59.7	59.3	59.0
60	65.0	64.7	64.4	64.1	63.7	63.4	63.0	62.7	62.4	62.0	61.7	61.4	61.0	60.7	60.3	60.0
61	66.0	65.7	65.3	65.0	64.7	64.3	64.0	63.7	63.4	63.0	62.7	62.4	62.0	61.7	61.3	61.0
62	67.0	66.7	66.3	66.0	65.7	65.3	65.0	64.7	64.4	64.0	63.7	63.4	63.0	62.7	62.3	62.0
63	68.0	67.7	67.3	67.0	66.6	66.3	66.0	65.7	65.4	65.0	64.7	64.4	64.0	63.7	63.3	63.0
64	68.9	68.6	68.3	68.0	67.6	67.3	67.0	66.7	66.4	66.0	65.7	65.4	65.0	64.7	64.3	64.0
65	69.9	69.6	69.3	68.9	68.6	68.3	68.0	67.6	67.3	67.0	66.7	66.4	66.0	65.7	65.3	65.0
66	70.8	70.5	70.2	69.9	69.5	69.2	68.9	68.6	68.3	67.9	67.6	67.3	67.0	66.7	66.3	66.0
67	71.8	71.5	71.2	70.8	70.5	70.2	69.9	69.6	69.3	68.9	68.6	68.3	68.0	67.7	67.3	67.0
68	72.7	72.4	72.1	71.8	71.5	71.2	70.9	70.6	70.2	69.9	69.6	69.3	69.0	68.7	68.3	68.0
69	73.7	73.4	73.1	72.8	72.5	72.2	71.9	71.5	71.2	70.9	70.6	70.3	70.0	69.6	69.3	69.0
70	74.7	74.3	74.0	73.7	73.4	73.1	72.8	72.5	72.2	71.9	71.6	71.3	71.0	70.6	70.3	70.0
71	75.6	75.3	75.0	74.7	74.4	74.1	73.8	73.5	73.2	72.9	72.6	72.3	72 0	71.6	71.3	71.0
72	76.6	76.3	76.0	75.7	75.3	75.0	74.7	74.4	74.1	73.8	73.5	73.2	72.9	72.6	72.3	72.0
73	77.6	77.3	77.0	76.7	76.3	76.0	75.7	75.4	75.1	74.8	74.5	74.2	73.9	73.6	73.3	73.0
74	78.6	78.3	78.0	77.7	77 3	77.0	76.7	76.4	76·1	75.8	75.5	75.2	74.9	74.6	74.3	74.0
75	79.5	79.2	78.9	78.6	78.3	78.0	77.7	77.4	77.1	76.8	76.5	76.2	75.9	75.6	75.3	75.0

TABLE *indicating the Actual Strength of Spirituous Liquors.*

Centesimal degrees.	DEGREES OF COLD.															
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°
76	80.5	80.2	79.9	79.6	79.3	79.0	78.7	78.4	78.1	77.8	77.5	77.2	76.9	76.6	76.3	76.0
77	81.5	81.2	80.9	80.6	80.3	80.0	79.7	79.4	79.1	78.8	78.5	78.2	77.9	77.6	77.3	77 0
78	82.4	82.1	81.9	81.6	81.3	81.0	80.7	80.4	80.1	79.8	79.5	79.2	78.9	78.6	78.3	78.0
79	83.3	83.1	82.8	82.5	82.2	81.9	81.6	81.4	81.1	80.8	80.5	80.2	79.9	79.6	79.3	79.0
80	84.3	84.0	83.7	83.5	83.2	82.9	82.6	82.3	82.0	81.7	81.5	81.2	80.9	80.6	80.3	80.0
81	85.2	85.0	84.7	84.4	84.2	83.9	83.6	83.3	83.0	82.7	82.4	82.2	81.9	81.6	81.3	81.0
82	86.2	85.9	85.6	85.4	85.1	84 8	84.5	84.2	84.0	83.7	83.4	83.1	82.9	82.6	82.3	82.0
83	87.1	86.8	86.6	86.3	86.1	85.8	85.5	85.2	85.0	84.7	84.4	84.1	83.9	83.6	83.3	83.0
84	88.0	87.8	87.5	87.3	87.0	86.7	86.5	86.2	85.9	85.7	85.4	85.1	84.8	84.6	84.3	84.0
85	88.9	88.7	88.5	88.2	87.9	87.7	87.4	87.2	86.9	86.6	86.4	86.1	85.8	85.5	85.3	85.0
86	89.9	89.6	89.4	89.2	88.9	88.6	88.4	88.1	87.9	87.6	87.4	87.1	86.8	86.5	86.3	86.0
87	90.8	90.5	90.3	90.1	89.8	89.6	89.3	89.1	88.8	88.6	88.3	88.0	87.8	87.5	87.3	87.0
88	91.7	91.5	91.2	91.0	90.8	90.5	90.2	90.0	89.8	89.5	89.3	89.0	88.7	88.5	88.2	88.0
89	92.6	92.4	92.2	91.9	91.7	91.5	91.2	91.0	90.7	90.5	90.2	90.0	89.7	89.5	89.2	89.0
90	93.6	93.3	93.1	92.9	92.7	92.4	92.2	91.9	91.7	91.5	91.2	91.0	90.7	90.5	90.2	90.0
91	94.5	94.3	94.0	93.8	93.6	93.4	93.1	92.9	92.7	92.5	92.2	92.0	91.7	91.5	91.2	91.0
92	95.3	95.1	94.9	94.7	94.5	94.3	94.1	93.9	93.6	93.4	93.2	92.9	92.7	92.5	92.2	92.0
93	96.2	96.0	95.8	95.6	95.4	95.2	95.0	94.8	94.6	94.4	94.2	93.9	93.7	93.5	93.2	93.0
94	97.1	96.9	96.7	96.5	96.3	96.1	95.9	95.7	95.5	95.3	95.1	94.9	94.7	94.4	94.2	94.0
95	98.0	97.8	97.6	97.4	97.2	97.0	96.8	96.6	96.4	96.2	96.0	95.8	95.6	95.4	95.2	95.0
96	98.8	98.6	98.5	98.3	98.1	97.9	97.8	97.6	97.4	97.2	97.0	96.8	96.6	96.4	96.2	96.0
97	99.7	99.5	99.3	99.2	99 0	98.8	98.7	98.5	98.3	98.1	98.0	97.8	97.6	97.4	97.2	97.0
98	100.0	100.0	100.0	100.0	99.9	99.7	99.6	99.4	99.2	99.1	98.9	98.7	98.5	98.4	98.2	98.0
99	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.7	99.5	99.3	99.2	99.0
100	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	100.0

TABLE *indicating the Actual Strength of Spirituous Liquors.*

Centesimal degrees.	DEGREES OF HEAT.														
	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°
1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.1	1.0	0.8	0.7	0.5	0.3	0.1	0.0
3	2.9	2.8	2.7	2.6	2.4	2.3	2.2	2.1	1.9	1.7	1.6	1.5	1.3	1.1	0.9
4	3.9	3.8	3.7	3.6	3.4	3.3	3.2	3.1	2.9	2.7	2.6	2.4	2.2	2.0	1.9
5	4.9	4.8	4.7	4.5	4.4	4.3	4.1	4.0	3.8	3.6	3.5	3.3	3.1	2.9	2.8
6	5.9	5.8	5.7	5.5	5.4	5.2	5.1	4.9	4.8	4.6	4.4	4.3	4.1	3.9	3.7
7	6.9	6.8	6.7	6.5	6.4	6.2	6.1	5.9	5.8	5.5	5.4	5.2	5.0	4.8	4.6
8	7.9	7.8	7.7	7.5	7.3	7.1	7.0	6.8	6.7	6.5	6.3	6.1	5.9	5.7	5.5
9	8.9	8.8	8.7	8.5	8.3	8.1	7.9	7.8	7.6	7.4	7.2	7.0	6.8	6.6	6.4
10	9.9	9.8	9.7	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.1	7.9	7.7	7.5	7.3
11	10.9	10.8	10.7	10.5	10.3	10.1	9.9	9.7	9.5	9.3	9.0	8.8	8.6	8.4	8.1
12	11.9	11.7	11.6	11.4	11.2	11.0	10.8	10.6	10.4	10.2	9.9	9.7	9.5	9.2	9.0
13	12.9	12.7	12.5	12.4	12.2	11.9	11.7	11.5	11.3	11.1	10.8	10.6	10.3	10.1	9.8
14	13.9	13.7	13.5	13.3	13.1	12.8	12.6	12.4	12.2	12.0	11.7	11.5	11.2	11.0	10.7
15	14.9	14.7	14.5	14.3	14.0	13.7	13.5	13.3	13.1	12.8	12.6	12.3	12.0	11.8	11.5
16	15.9	15.6	15.4	15.2	14.9	14.6	14.4	14.1	13.9	13.6	13.4	13.1	12.8	12.6	12.3
17	16.9	16.6	16.3	16.1	15.8	15.5	15.3	15.0	14.8	14.5	14.2	14.0	13.7	13.4	13.1
18	17.8	17.5	17.3	17.0	16.7	16.4	16.2	15.9	15.7	15.4	15.1	14.8	14.5	14.2	13.9
19	18.7	18.4	18.2	17.9	17.6	17.3	17.0	16.7	16.5	16.2	15.9	15.6	15.3	15.0	14.7
20	19.7	19.4	19.1	18.8	18.5	18.2	17.9	17.6	17.4	17.1	16.7	16.5	16.1	15.8	15.5
21	20.7	20.4	20.1	19.8	19.5	19.1	18.8	18.5	18.3	18.0	17.7	17.4	17.0	16.7	16.4
22	21.7	21.4	21.1	20.8	20.5	20.1	19.8	19.5	19.2	18.9	18.6	18.3	18.0	17.6	17.3
23	22.7	22.4	22.0	21.7	21.4	21.1	20.7	20.4	20.1	19.8	19.5	19.2	18.9	18.5	18.2
24	23 7	23.4	23.0	22.7	22.4	22.1	21.7	21.4	21.1	20.7	20.4	20.1	19.7	19.4	19.1
25	24.7	24.4	24.0	23.6	23.3	23.0	22.6	22.3	21.9	21.6	21.3	20.9	20.6	20.3	19.9

TABLE *indicating the Actual Strength of Spirituous Liquors.*

Centesimal degrees.	DEGREES OF HEAT.														
	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°
26	25.7	25.4	25.0	24.6	24.3	23.9	23.6	23.2	22.8	22.5	22.2	21.8	21.5	21.1	20.8
27	26.6	26.3	25.9	25.5	25.2	24.8	24.4	24.1	23.7	23.3	23.0	22.7	22.3	21.9	21.6
28	27.6	27.3	26.9	26.5	26.1	25.7	25.3	25.0	24.6	24.3	23.9	23.6	23.2	22.8	22.5
29	28.6	28.2	27.8	27.4	27.1	26.7	26.3	25.9	25.5	25.2	24.8	24.4	24.0	23.7	23.3
30	29.6	29.2	28.8	28.4	28.0	27.6	27.2	26.8	26.4	26.1	25.7	25.3	24.9	24.5	24.2
31	30.6	30.2	29.8	29.4	29.0	28.6	28.2	27.8	27.4	27.0	26.6	26.2	25.8	25.4	25.1
32	31.6	31.2	30.8	30.4	30.0	29.6	29.2	28.8	28.4	28.0	27.6	27.2	26.8	26.4	26.0
33	32.5	32 1	31.7	31.3	30.9	30.5	30.1	29.7	29.3	28.9	28.5	28.1	27.7	27.3	26.9
34	33.5	33.1	32.7	32.3	31.9	31.5	31.1	30.7	30.3	29.9	29.5	29.1	28.7	28.3	27.9
35	34.5	34.1	33.7	33.3	32.9	32.5	32.1	31.7	31.3	30.9	30.5	30.1	29.7	29.3	28.9
36	35.5	35.1	34.7	34.3	33.9	33.5	33.1	32.7	32.3	31.9	31.5	31.1	30.7	30.3	29.9
37	36.5	36.1	35.7	35.3	34.9	34.5	34.1	33.7	33.3	32.9	32.5	32.1	31.7	31.3	30.9
38	37.5	37.1	36.7	36.3	35.9	35.5	35.1	34.7	34.3	33.9	33.5	33.1	32.7	32.3	31.9
39	38.5	38.1	37.7	37.3	36.9	36.5	36.1	35.7	35.3	34.9	34.5	34.1	33.7	33.3	32.9
40	39.5	39.1	38.7	38.3	37.9	37.5	37.1	36.7	36.3	35.9	35.5	35.1	34.7	34.3	33.9
41	40.6	40.2	39.8	39.4	39.0	38.6	38.2	37.8	37.4	37.0	36.5	36.1	35.7	35.3	34.9
42	41.6	41.2	40.8	40.4	40.0	39.6	39.2	38.8	38.4	38.0	37.6	37.2	36.8	36.3	35.9
43	42.6	42.2	41.8	41.4	41.0	40.6	40.2	39.8	39.4	39.0	38.6	38.2	37.8	37.4	37.0
44	43.6	43.2	42.8	42.5	42.1	41.7	41.3	40.9	40.5	40.1	39.7	39.3	38.9	38.5	38.1
45	44.6	44.2	43.8	43.5	43.1	42.7	42.3	41.9	41.5	41.1	40.7	40.3	39.9	39.5	39.1
46	45.6	45.2	44.9	44.5	44.1	43.7	43.3	42.9	42.5	42.2	41.8	41.4	41.0	40.6	40.2
47	46.6	46.2	45.9	45.5	45.1	44.8	44.3	43.9	43.6	43.2	42.8	42.4	42.0	41.6	41.2
48	47.6	47.2	46.9	46.5	46.1	45.8	45.3	44.9	44.6	44.2	43.8	43.4	43.0	42.6	42.3
49	48.6	48.3	47.9	47.5	47.2	46.8	46.4	46.0	45.6	45.2	44.9	44.5	44.1	43.7	43.3
50	49.6	49.3	48.9	48.5	48.2	47.8	47.4	47.0	46.6	46.3	45.9	45.5	45.1	44.7	44.3

TABLE *indicating the Actual Strength of Spirituous Liquors.*

Centesimal degrees.	DEGREES OF HEAT.														
	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°
51	50.6	50.3	49.9	49.5	49.2	48.8	48.4	48.0	47.6	47.3	46.9	46.5	46.1	45.7	45.4
52	51.6	51.3	50.9	50.6	50.2	49.8	49.4	49.1	48.7	48.3	47.9	47.6	47.2	46.8	46.4
53	52.6	52.3	51.9	51.6	51.2	50.8	40.4	50.1	49.7	49.3	49.0	48.6	48.2	47.8	47.5
54	53.6	53.3	52.9	52.6	52.2	51.8	51.4	51.1	50.7	50.3	50.0	49.6	49.2	48.9	48.5
55	54.6	54.3	53.9	53.6	53.2	52.9	52 5	52.1	51.8	51.4	51.0	50.7	50.3	49.9	49.6
56	55.6	55.3	54.9	54.6	54.2	53.9	53.5	53.1	52.8	52.4	52.0	51.7	51.3	51.0	50.6
57	56.6	56.3	55.9	55.6	55.2	54.9	54 5	54.1	53.8	53.4	53.0	52.7	52.3	52.0	51.6
58	57.6	57.3	56.9	56.6	56.2	55.9	55.5	55.1	54.8	54.4	54.0	53.7	53.3	53.0	52.6
59	58.6	58.3	57.9	57.6	57.2	56.9	56.5	56.1	55.8	55.5	55.1	54.8	54.4	54 0	53.6
60	59.6	59.3	58.9	58.6	58.2	57.9	57.5	57.1	56.8	56.5	56.1	55.8	55.4	55.0	54.7
61	60.6	60.3	59.9	59.6	59.2	58.9	58 5	58.1	57.8	57.5	57.1	56.8	56.4	56.0	55.7
62	61.7	61.3	61.0	60.6	60.3	59.9	59.5	59.2	58.9	58.5	58.1	57.8	57.5	57.1	56.7
63	62.7	62.3	62.0	61.6	61.3	61.0	60.6	60.2	59.9	59.5	59.2	58.8	58.5	58.1	57.8
64	63.7	63.3	63.0	62.7	62.3	62.0	61.6	61.3	61.0	60.6	60.2	59.9	59.5	59.2	58.8
65	64.7	64.3	64.0	63.7	63.3	63.0	62.7	62.3	62.0	61.6	61.3	60.9	60.6	60.2	59.9
66	65.7	65.3	65.0	64.7	64.3	64.0	63.7	63.3	63.0	62.6	62.3	61.9	61.6	61.2	60.9
67	66.7	66.3	66.0	65.7	65.3	65.0	64.7	64.3	64.0	63.7	63.3	63.0	62.6	62.3	61.9
68	67.7	67.3	67.0	66.7	66.4	66.0	65.7	65.4	65.0	64.7	64.3	64.0	63.7	63.3	63.0
69	68.7	68.3	68.0	67.7	67.4	67.0	66.7	66.4	66.0	65.7	65.3	65.0	64.7	64.3	64.0
70	69.7	69.3	69.0	68.7	68.4	68.1	67.8	67.4	67.1	66.7	66.4	66.0	65.7	65.4	65.0
71	70.7	70.3	70.0	69.7	69.4	69.1	68.8	68.4	68.1	67.8	67.4	67.1	66.8	66.4	66.1
72	71.7	71.3	71.0	70.7	70.4	70.1	69.8	69.4	69.1	68.8	68.4	68.1	67.8	67.4	67.1
73	72.7	72.3	72.0	71.7	71.4	71.1	70.8	70.5	70.1	69.8	69.5	69.2	68.8	68.5	68.2
74	73.7	73.3	73.0	72.7	72.4	72.1	71.8	71.5	71.2	70.8	70.5	70.2	69.9	69.5	69.2
75	74.7	74.3	74.0	73.7	73.4	73.1	72.8	72.5	72.2	71.8	71.5	71.2	70.9	70.6	70.3

TABLE *indicating the Actual Strength of Spirituous Liquors.*

Centesimal degrees.	DEGREES OF HEAT.														
	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°
76	75.7	75.4	75.1	74.7	74.4	74.1	73.8	73.5	73.2	72.8	72.5	72.2	71.9	71.6	71.3
77	76.7	76.4	76.1	75.8	75.5	75.2	74.8	74.5	74.2	73.9	73.6	73.3	73.0	72.6	72.3
78	77.7	77.4	77.1	76.8	76.5	76.2	75.9	75.5	75.2	74.9	74.6	74.3	74.0	73.7	73.3
79	78.7	78.4	78.1	77.8	77.5	77.2	76.9	76.6	76.3	76.0	75.6	75.3	75.0	74.7	74.4
80	79.7	79.4	79.1	78.8	78.5	78.2	77.9	77.6	77.3	77.0	76.7	76.3	76.0	75.7	75.4
81	80.7	80.4	80.1	79.8	79.5	79.2	78.9	78.6	78.3	78.0	77.7	77.4	77.1	76.7	76.4
82	81.7	81.4	81.1	80.8	80.5	80.2	79.9	79.6	79.3	79.0	78.7	78.4	78.1	77.8	77.5
83	82.7	82.4	82.1	81.9	81.6	81.3	81.0	80.7	80.4	80.1	79.8	79.5	79.2	78.9	78.6
84	83.7	83.4	83.1	82.9	82.6	82.3	82.0	81.7	81.4	81.1	80.8	80.5	80.2	79.9	79.6
85	84.7	84.4	84.1	83.9	83.6	83.3	83.0	82.7	82.4	82.2	81.8	81.5	81.2	80.9	80.6
86	85.7	85.4	85.2	84.9	84.6	84.3	84.0	83.8	83.5	83.2	82.9	82.6	82.3	82.0	81.7
87	86.7	86.4	86.2	85.9	85.6	85.3	85.0	84.8	84.5	84.2	83.9	83.6	83.3	83.0	82.7
88	87.7	87.4	87.2	86.9	86.6	86.4	86.1	85.8	85.5	85.2	84.9	84.7	84.4	84.1	83.8
89	88.7	88.4	88.2	87.9	87.7	87.4	87.1	86.8	86.5	86.3	86.0	85.7	85.4	85.1	84.9
90	89.7	89.5	89.2	88.9	88.7	88.4	88.2	87.9	87.6	87.4	87.1	86.8	86.5	86.2	86.0
91	90.8	90.5	90.2	90.0	89.7	89.5	89.2	89.0	88.7	88.4	88.2	87.9	87.6	87.3	87.1
92	91.8	91.5	91.3	91.1	90.8	90.5	90.2	90.0	89.7	89.5	89.2	89.0	88.7	88.4	88.2
93	92.8	92.6	92.3	92.1	91.8	91.6	91.3	91.1	90.8	90.6	90.3	90.1	89.8	89.5	89.3
94	93.8	93.6	93.3	93.1	92.9	92.6	92.4	92.1	91.9	91.6	91.4	91.1	90.9	90.6	90.4
95	94.8	94.6	94.3	94.1	93.9	93.7	93.4	93.2	93.0	92.7	92.5	92.2	92.0	91.7	91.5
96	95.8	95.6	95.4	95.2	95.0	94.7	94.5	94.3	94.1	93.8	93.6	93.4	93.1	92.9	92.7
97	96.8	96.6	96.4	96.2	96.0	95.8	95.6	95.4	95.2	94.9	94.7	94.5	94.3	94.1	93.8
98	97.8	97.6	97.4	97.3	97.1	96.9	96.7	96.5	96.2	96.0	95.8	95.6	95.4	95.2	95.0
99	98.8	98.7	98.5	98.3	98.1	97.9	97.7	97.5	97.3	97.1	97.9	96.7	96.5	96.3	96.1
100	99.8	99.7	99.5	99.3	99.1	99.0	98.8	98.6	98.4	98.2	98.1	97.9	97.7	97.5	97.3

TABLE *by which to find the value of degrees on the Alcoholometer of Cartier in terms of the centesimal Alcoholometer.*

Centesimal degrees.	Degrees of Cartier.	Centesimal degrees.	Degrees of Cartier.	Centesimal degrees.	Degrees of Cartier.	Centesimal degrees.	Degrees of Cartier.	Centesimal degrees.	Degrees of Cartier.
0	10″	21	13 3/5	42	17 1/8	63	23 1/2	84	32 3/4
1	10 1/4	22	13 4/5	43	17 3/8	64	23 7/8	85	33 1/4
2	10 3/8	23	13 5/8	44	17 5/8	65	24 1/4	86	33 7/8
3	10 5/8	24	13 3/4	45	17 7/8	66	24 5/8	87	34 3/8
4	10 3/4	25	13 7/8	46	18 1/8	67	25″	88	35″
5	10 7/8	26	14 1/8	47	18 3/8	68	25 3/8	89	35 5/8
6	11 1/8	27	14 1/4	48	18 5/8	69	25 3/4	90	36 1/8
7	11 1/4	28	14 3/8	49	18 7/8	70	26 1/8	91	36 7/8
8	11 3/8	29	14 1/2	50	19 1/4	71	26 5/8	92	37 1/2
9	11 5/8	30	14 5/8	51	19 1/2	72	27″	93	38 1/4
10	11 3/4	31	14 7/8	52	19 3/4	73	27 1/2	94	38 7/8
11	11 7/8	32	15″	53	20 1/8	74	27 7/8	95	39 5/8
12	12 1/8	33	15 1/4	54	20 3/8	75	28 3/8	96	40 1/2
13	12 1/4	34	15 3/8	55	20 3/4	76	28 7/8	97	41 1/4
14	12 3/8	35	15 5/8	56	21″	77	29 1/4	98	42 1/4
15	12 1/2	36	15 3/4	57	21 3/8	78	29 3/4	99	43 1/8
16	12 5/8	37	16″	58	21 3/4	79	30 1/4	100	44 1/8
17	12 3/4	38	16 1/8	59	22″	80	30 3/4		
18	12 7/8	39	16 3/8	60	22 3/8	81	31 1/4		
19	13″	40	16 5/8	61	22 3/4	82	31 3/4		
20	13 1/4	41	16 7/8	62	23 1/8	83	32 1/4		

[As it may be interesting to some, the translator has taken the liberty of adding the following tables from Fownes' Chemistry, which institute a comparison between the specific gravity of different liquids both heavier and lighter than water, and a third which indicates the true alcoholic strength of a spirituous liquor as indicated by its specific gravity.]

Comparison of the Degrees of Baumé's Hydrometer with the real Specific Gravities.

1. For liquids heavier than water.

Degrees	Specific gravity.	Degrees	Specific gravity.	Degrees	Specific gravity.	Degrees	Specific gravity.	Degrees	Specific gravity.
0	1.000	16	1.118	32	1.267	48	1.462	64	1.727
1	1.007	17	1.126	33	1.277	49	1.476	65	1.747
2	1.013	18	1.134	34	1.288	50	1.490	66	1.767
3	1.020	19	1.143	35	1.299	51	1.495	67	1.788
4	1.027	20	1.152	36	1.310	52	1.520	68	1.809
5	1.034	21	1.160	37	1.321	53	1.535	69	1.831
6	1.041	22	1.169	38	1.333	54	1.551	70	1.854
7	1.048	23	1.178	39	1.345	55	1.567	71	1.877
8	1.056	24	1.188	40	1.357	56	1.583	72	1.900
9	1.063	25	1.197	41	1.369	57	1.600	73	1.924
10	1.070	26	1.206	42	1.381	58	1.617	74	1.949
11	1.078	27	1.216	43	1.395	59	1.634	75	1.974
12	1.085	28	1.225	44	1.407	60	1.652	76	2.000
13	1.094	29	1.235	45	1.420	61	1.670		
14	1.101	30	1.245	46	1.434	62	1.689		
15	1.109	31	1.256	47	1.448	63	1.708		

2. Baumé's Hydrometer for liquids lighter than water.

Degrees	Specific gravity.	Degrees	Specific gravity.	Degrees	Specific gravity.	Degrees	Specific gravity.	Degrees	Specific gravity.
10	1.000	21	0.930	32	0.869	43	0.816	54	0.768
11	0.993	22	0.924	33	0.864	44	0.811	55	0.764
12	0.986	23	0.918	34	0.859	45	0.807	56	0.760
13	0.980	24	0.913	35	0.854	46	0.802	57	0.757
14	0.973	25	0.907	36	0.849	47	0.798	58	0.753
15	0.967	26	0.901	37	0.844	48	0.794	59	0.749
16	0.960	27	0.896	38	0.839	49	0.789	60	0.745
17	0.954	28	0.890	39	0.834	50	0.785		
18	0.948	29	0.885	40	0.830	51	0.781		
19	0.942	30	0.880	41	0.825	52	0.777		
20	0.936	31	0.874	42	0.820	53	0.773		

These two tables are on the authority of M. Francœur; they are taken from the *Handwörterbuch der Chemie* of Liebig and Poggendorf. Baumé's hydrometer is very commonly used on the Continent, especially for liquids heavier than water. For lighter liquids the hydrometer of Cartier is often employed in France. Cartier's degrees differ but little from those of Baumé.

In the United Kingdom, Twaddell's hydrometer is a good deal used for dense liquids. This instrument is so graduated that the real sp. gr. can be deduced by an extremely simple method from the degree of the hydrometer, namely, by multiplying the latter by 5 and adding 1000; the sum is the sp. gr., water being 1000. Thus 10° Twaddell indicates a sp. gr. of 1050, or 1.05; 90° Twaddell, 1450, or 1.45.—*Fownes' Chemistry*.

TABLE *of the proportion by weight of absolute or real Alcohol in* 100 *parts of spirits of different specific gravities.* (*Fownes.*)

Sp. gr. at 60° (15°.5 C.)	Percent. of real alcohol.	Sp. gr. at 60° (15°.5 C.)	Percent. of real alcohol.	Sp. gr. at 60° (15°.5 C.)	Percent. of real alcohol.	Sp. gr. at 60° (15°.5 C.)	Percent. of real alcohol.
0.9991	0.5	0.9638	26	0.9135	52	0.8533	78
0.9981	1	0.9623	27	0.9113	53	0.8508	79
0.9965	2	0.9609	28	0.9090	54	0.8483	80
0.9947	3	0.9593	29	0.9069	55	0.8459	81
0.9930	4	0.9578	30	0.9047	56	0.8434	82
0.9914	5	0.9560	31	0.9025	57	0.8408	83
0.9898	6	0.9544	32	0.9001	58	0.8382	84
0.9884	7	0.9528	33	0.8979	59	0.8357	85
0.9869	8	0.9511	34	0.8956	60	0.8331	86
0.9855	9	0.9490	35	0.8932	61	0.8305	87
0.9841	10	0.9470	36	0.8908	62	0.8279	88
0.9828	11	0.9452	37	0.8886	63	0.8254	89
0.9815	12	0.9434	38	0.8863	64	0.8228	90
0.9802	13	0.9416	39	0.8840	65	0.8199	91
0.9789	14	0.9396	40	0.8816	66	0.8172	92
0.9778	15	0.9376	41	0.8793	67	0.8145	93
0.9766	16	0.9356	42	0.8769	68	0.8118	94
0.9753	17	0.9335	43	0.8745	69	0.8089	95
0.9741	18	0.9314	44	0.8721	70	0.8061	96
0.9728	19	0.9292	45	0.8696	71	0.8031	97
0.9716	20	0.9270	46	0.8672	72	0.8001	98
0.9704	21	0.9249	47	0.8649	73	0.7969	99
0.9691	22	0.9228	48	0.8625	74	0.7938	100
0.9678	23	0.9206	49	0.8603	75		
0.9665	24	0.9184	50	0.8581	76		
0.9652	25	0.9160	51	0.8557	77		

Alcoholometric Scale of M. Strope.

M. Stropé, an optician at Orleans, has invented a very convenient and portable little instrument, which is intended for correcting the apparent degrees indicated by the alcoholometer when the temperature is above or below 15 degrees Centigrade. This instrument, which M. Stropé has called the *alcoholometric scale*, fully replaces the table which was formerly used to indicate the alcoholic strength of liquids. The alcoholometric scale consists of a wooden rod, with a sliding scale, on which the degrees of spirituosity are placed on the two sides right and left, and the degrees of temperature are marked on the sliding scale. When it is desired to ascertain the strength of any spirits, it is only necessary to slide the scale so as to bring the degree indicating the temperature opposite the alcoholic degree, as obtained by the hydrometer, and at once read off the true strength of the liquor.

Let us suppose a brandy the apparent strength of which by the alcoholometer is 48 degrees, at a temperature of five degrees above zero: what is its real strength? The sliding scale is moved so that the fifth degree shall correspond with the 48th division of the fixed scale, and on seeking out the 15th degree, as fixed by the law, we shall see that the real strength of the brandy is 51½ degrees. If, on the contrary, the temperature be at 20 degrees, it will be necessary to lower the scale until the 20th degree corresponds to the 48th division, and on again seeking the 15th degree, the scale indicates the real strength to be 46 degrees.

Experimental Stills.

Areometers only indicate accurately the alcoholic strength of liquids submitted to them, when these liquids contain alcohol and water only; because, in all other cases, the substances dissolved in fermented or other liquors affect their density.

The best method of ascertaining the proportion of alcohol contained in a wine, or other spirituous liquor, is to distil a portion of it, note the volume of weak alcohol obtained, find its degree by the alcoholometer, and then calculate the quantity of absolute alcohol which it represents. Descrozilles invented a small still for this assay, which Gay Lussac, and, more recently, M. Duval, have improved.

Assay Still of Gay Lussac.

This apparatus, Fig. 8, Pl. VI., consists of a small copper still *A*, with a cap *B*, having on one side, at its upper part, an opening *C* which communicates with the tube *D*, which is bent into a spiral, and fixed in the copper refrigerator *E*.

To this still are added two graduated proof glasses. The larger *F* has 300 divisions, which represent 150 millilitres. The second *G* is also divided into millilitres,

and has 180 divisions, of which 100 represent 50 millilitres.

When this still is to be used, the wine is first poured into the larger proof glass up to the division 300. This is introduced into the still, the refrigerator attached, and the still set in an iron cylinder perforated at the top, which fills the place of a furnace; the whole is heated by a spirit lamp *J*.

The small proof glass is placed under the refrigerator to collect the alcoholic product. During the distillation care must be taken to keep the water in the refrigerator cold, and continually to sprinkle the cloth which surrounds the tube of the cap. The distillation is arrested when precisely one-third of the wine used has been collected in the proof glass; that is to say, when the liquid has risen to division 100. The alcoholic richness of this product is then ascertained by the centesimal alcoholometer of Gay Lussac, and, on dividing the number which represents it, by three, we find the alcoholic strength of the wine employed. Let us suppose, for example, that, by the process just described, we have obtained 100 parts of alcohol at 24.5 of the centesimal alcoholometer at the temperature of 15°, we shall conclude that the alcoholic richness of the wine is—

$$\frac{24.50}{3} = 8.166$$

That is to say, that it contains 8.166 parts of absolute or perfectly pure alcohol.

Since this method of examination immediately determines the quantity of absolute alcohol contained in a given sample of wine, it will be easy to ascertain, what will be the contents of a spirit of any strength whatever.

Assay Still of M. J. Salleron.

This new alcoholometer has been adopted by the administration of the assize and of the octroi, at Paris, for determining the tax on liquors.

This apparatus, constructed after the manner of a still, is intended to measure the alcoholic strength of

spirituous liquors, whatever be their nature or the quantity of foreign substances they may contain in solution. It should be used when the alcoholometer of Gay Lussac is in default; that is to say, when examining the standard of wines, saccharine liquors, beer, cider, varnish, &c.; in a word, all liquors, into the composition of which salts, sugar, gums, and coloring substances enter, and which modify or falsify the indications of the ordinary alcoholometer.

The use of the still consists in separating from the liquid all the foreign substances it may contain, by isolating a mixture of water and alcohol, susceptible of being tested by the alcoholometer.

The accuracy, simplicity, and small volume of this instrument render it exceedingly convenient for practical use.

This apparatus, which consists of the following pieces, is packed in a small box. See Fig. 9, Pl. VI.

1. A spirit lamp *A*.
2. A glass globe *B*, which answers to the boiler of the still.
3. Coil contained in the refrigerator *C*, which is supported by three copper rods.

The coil is connected with the boiler by means of an India-rubber tube *D*, terminated by the stopper *E*, which fits the neck of the globe *B*.

4. Proof jar *F*, on which are marked three divisions. One, *a*, for measuring the wine intended for distillation; the two others, marked ½ and ⅓, are for measuring the liquid collected under the coil.
5. An areometer *G*, the divisions of which correspond to those of the alcoholometer of Gay Lussac.
6. A small thermometer *H*.
7. A small glass tube *J*, which is used as a pipette.

The instrument is used as follows: viz. The globe *B* is placed over the lamp *A*, the liquid under examination is measured in the proof glass *F*, by the assistance of the pipette *J*, the surface is adjusted accurately to the mark *a*.

The contents of the proof glass are poured into the globe, the stopper *E* firmly fixed in its place, and the refrigerator *C* filled with cold water, to put the apparatus in operation. It only remains to place the proof glass under the worm and light the lamp.

The wine soon begins to boil, the vapor enters the coil where it condenses and flows into the proof glass.

The first portion of the liquid collected is highly concentrated alcohol, that following is less concentrated, and the proportion of alcohol gradually diminishes, until at last only pure water flows from the coil. The operation may then be suspended and the lamp extinguished. But how is it to be known that all of the alcohol has been distilled and that there is no more in the globe? The means are easy enough. Where an ordinary wine is tested it is certain beforehand that its alcohol does not exceed 13 or 15 per cent.; if, then, one-third of the liquid poured into the globe, that is, 33 per cent. of its contents, be drawn off, we may be assured that not only all of the alcohol, but an equal volume of water, has been distilled off and collected in the proof glass; if the liquid in question is highly spirituous as Madeira wine for example, or a sweet liquor which may contain 20 or 25 per cent. of alcohol, it is evident that if only one-third of its volume is drawn off there will be great danger of not obtaining all the alcohol which it contains, and of leaving a portion of it still in the globe. It is therefore necessary to extend the distillation so as to draw off one-half instead of one-third.

In conclusion, common wines (*vins ordinaires*), beer, cider, and all liquors the alcoholic strength of which does not exceed 12 or 15 per cent. should be distilled to one-third. Heady wines, like those of Cette, Madeira, etc., sweet liquors, and in fine, all liquors in which the alcohol varies from 15 to 25 per cent. should be distilled to one-half. It is hardly necessary to say that all liquors, the strength of which is not known approximatively, should be distilled to one-half, in order thereby to avoid all chance of error.

It sometimes happens in distilling a liquor in which the alcoholic fermentation was incomplete, that so great a quantity of foam rises in the globe *B* that a portion of the liquor contained in it passed over unchanged with the distillate. This inconvenience is avoided, or prevented by pouring two or three drops of oil into the globe at the beginning of the operation.

When we have collected in the proof glass enough of the liquor to be assured that we have all the alcohol contained in the wine, the lamp is extinguished and water is poured into the proof glass until it is filled exactly to the level of the mark *x*. In order to perform this operation with ease and precision, we make use of the pipette *J*, which lets the water fall drop by drop. The mixture is well shaken and the alcoholometer and thermometer are simultaneously plunged into it (the groove in the side of the proof glass is intended to receive the thermometer without its interfering with the motion of the alcoholometer).

It is well to moisten the stem of the alcoholometer slightly in order that it may float freely in the liquid. This may be accomplished with the greatest ease by passing the stem between the lips.

The indications of the two instruments are noted and the real strength of the liquid is sought for in the table accompanying the instrument.

In the absence of this table, that which we have given on page 256 and following (explained on page 254) will answer the purpose. The result is exactly the same.

Example.—The alcoholometer indicates 10 degrees and the thermometer 29 degrees. We find by the table that the liquor only weighs 7.5.

And another example.—The alcoholometer marks 18 degrees and the thermometer 11 degrees. We find by the degrees designated that the liquor weighs 19 degrees.

The alcoholometer which accompanies the Salleron still is only graduated for 25 or 30 degrees; it might be supposed that it could be used only for measuring such liquors as do not exceed an alcoholic richness of 25

or 30 per cent., but this is an error. If the precaution is taken to dilute the spirit under examination with a known proportion of water, the most highly spirituous liquors may be operated on. In fact, if we measure the liquor in the proof glass to the mark ½ or ⅓, and then fill to the mark *a* with pure water, the strength of the liquor will have been diminished one-half or two-thirds. The indications of the alcoholometer multiplied by two or three will then give the actual strength.

CHAPTER XI.

REDUCTION OF SPIRITUOUS LIQUORS. IMPROVING. INCREASING THE STRENGTH OR RAISING THE PROOF.

Reduction.

THE weakening of a spirituous liquor by mixing it with water or another spirit of less strength is called in the trade *reduction* or *watering*.

We indicate in a table of reduction which is appended, the number of litres and decilitres of water that it is necessary to add to a hectolitre of *spirit* or brandy of any known degree to dilute it, that is, to transform it into another spirituous liquor, also of a known degree, but weaker.

Throughout this table we suppose that the two liquids (water and alcohol) have the temperature of 15°. If the spirit is not at this temperature, the strength should be estimated at this degree by means of the table of true alcoholic strength given above. As the rate of expansion for water between 0° and 30° is much less than that of alcohol, it will not materially affect the result if no account is taken of its temperature.

The first column of the table consists of the number which indicates the degree of the spirit to be reduced. The second column commencing at 38°, and always increasing as we descend, by unity, indicates the degree

to which the spirit is to be reduced from the degree as shown in the first column.

The third column indicates the number of litres of water that must be added to the hectolitre of spirit or brandy whose degree is indicated in the first column, to reduce it to the degree as given in the second column.

When it is desired, for example, to reduce 100 litres of spirit at 90° to make a spirit at 49°, we seek in the column headed *degree to be reduced* for the number 90, look down the next column for the number 49, and we find opposite to it in the third column the number 88 litres and 6 decilitres, which indicates the quantity of water to be added; that is to say, with 100 litres of spirit at 90°, we ought to produce 188.6 litres of spirit at 49°, if the contraction which takes place in the mixture did not cause a loss of about 4 per cent.

It is now easy to find the volume of water which it is necessary to add to any given quantity of spirit of a known strength to reduce it to an inferior degree, it being sufficient to search in the table for the quantity of water necessary to dilute 100 litres of this spirit, and multiply the number indicating this volume by that of the spirit and divide the product by 100.

Example.—It is required to convert a pipe of spirits at 85°, the quantity being 632 litres, into brandy at 46°. The table indicates that it requires 89.1 litres of water to reduce 100 litres of spirit at 85° to spirit at 46°. Multiply 632 by 89.1, and we obtain the product, 563.112, which being divided by 100 gives 563.1 litres for the quantity of water to be added to the amount of spirits given.

Second Example.—It is required to reduce 40 litres of brandy at 58° to brandy at 49°. The table indicates for 100 litres of spirit, 19 litres of water; multiply 40 by 19 gives 760, which divided by 100 gives 7.6 litres as the quantity of water to be added to the brandy.

When it is proposed to obtain from a spirit of known strength, a certain measure of another spirit of inferior degree, the quantity of spirit necessary to be employed is found *by multiplying the given measure by the number*