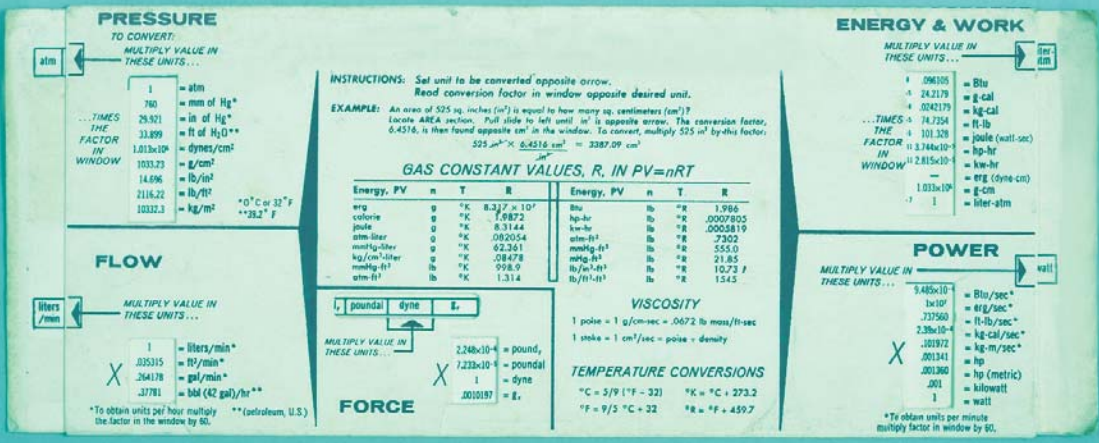
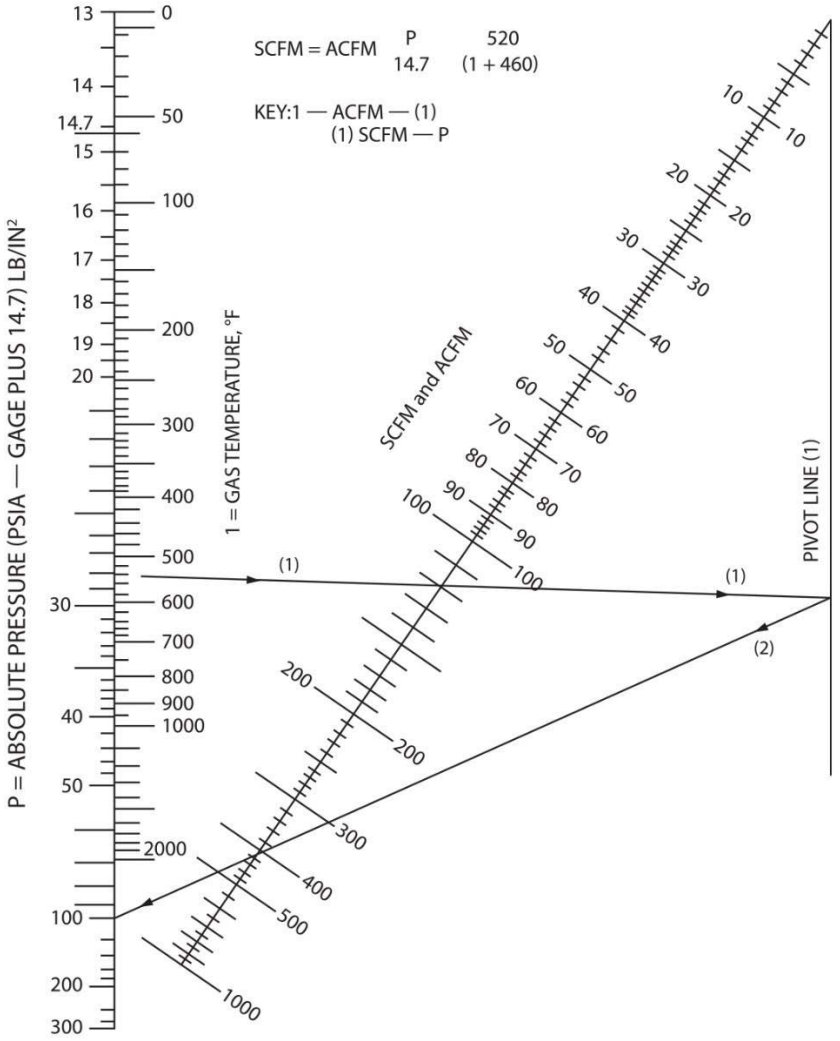
UNIT CONVERSIONS



Conversions - Standard CFM to Actual CFM

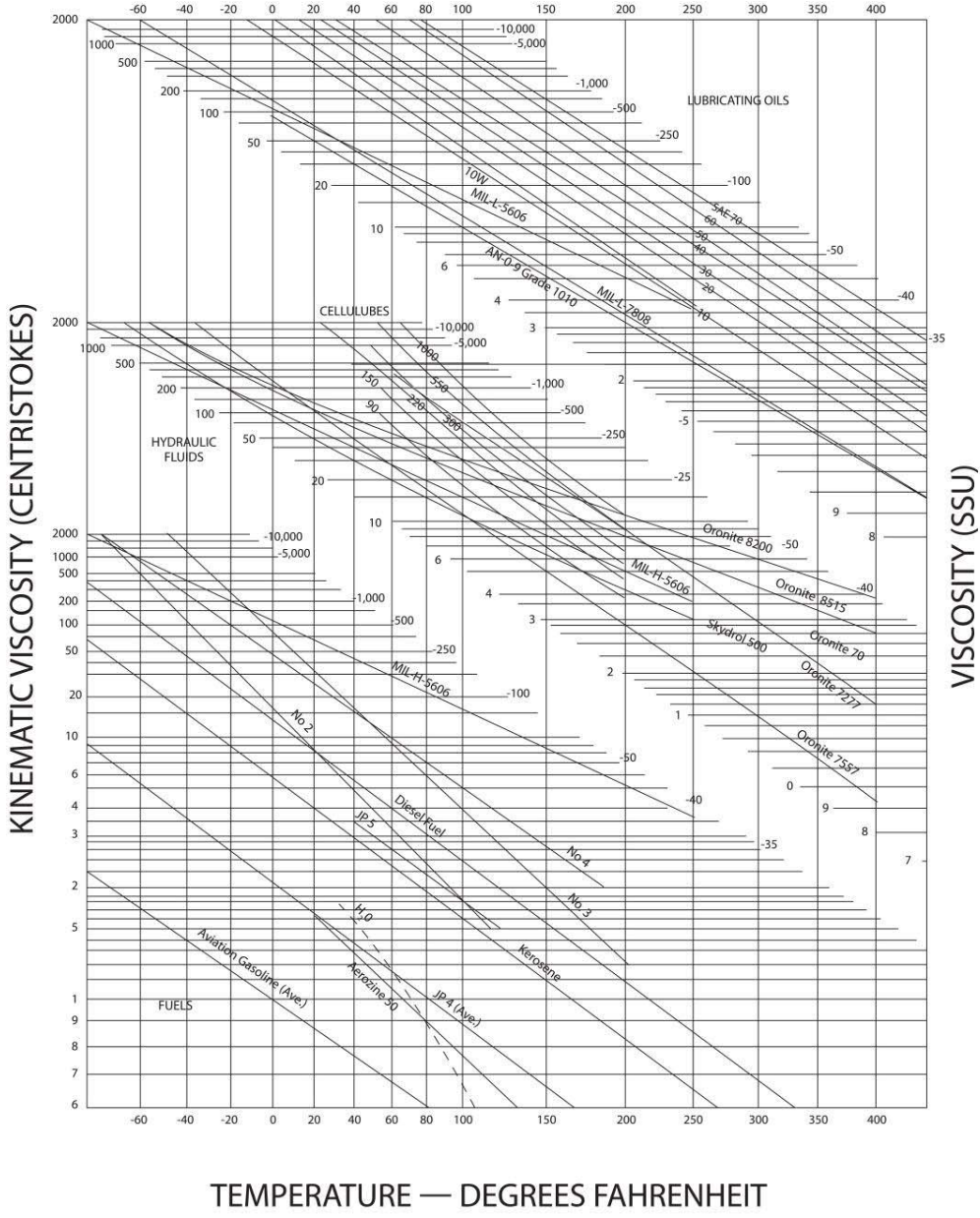


EXAMPLE:
A dryer can handle 120 ACFM gas at 540°F and 1000 psia. What is its SCFM capacity?

SOLUTION:
Align t = 540°F with ACFM = 120 and mark (1); align (1) with P = 1000-(10)•100 and read SCFM = (10)•425-4250

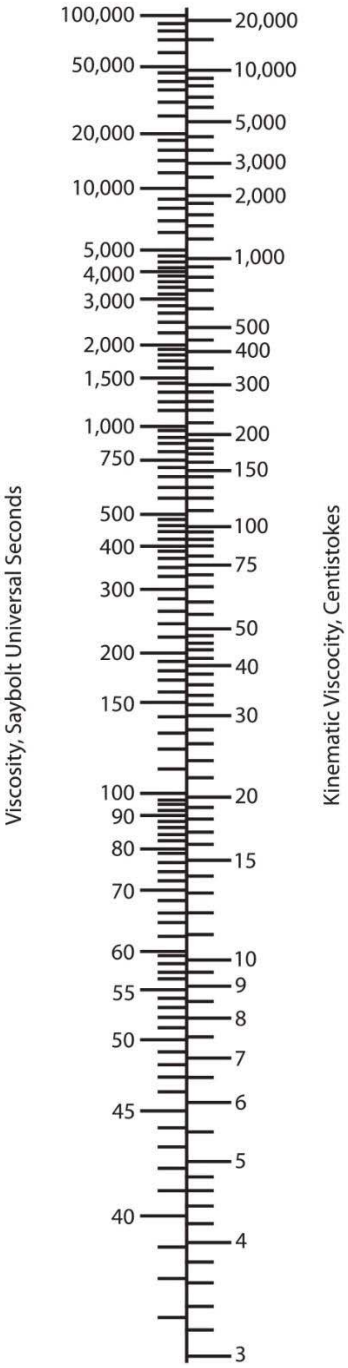
NOTE:
If P scale is multiplied by 10, 100, etc., multiply SCFM scale by same number. Also, SCFM and ACFM scales can be simultaneously multiplied by the same factor.

Fluid Viscosities

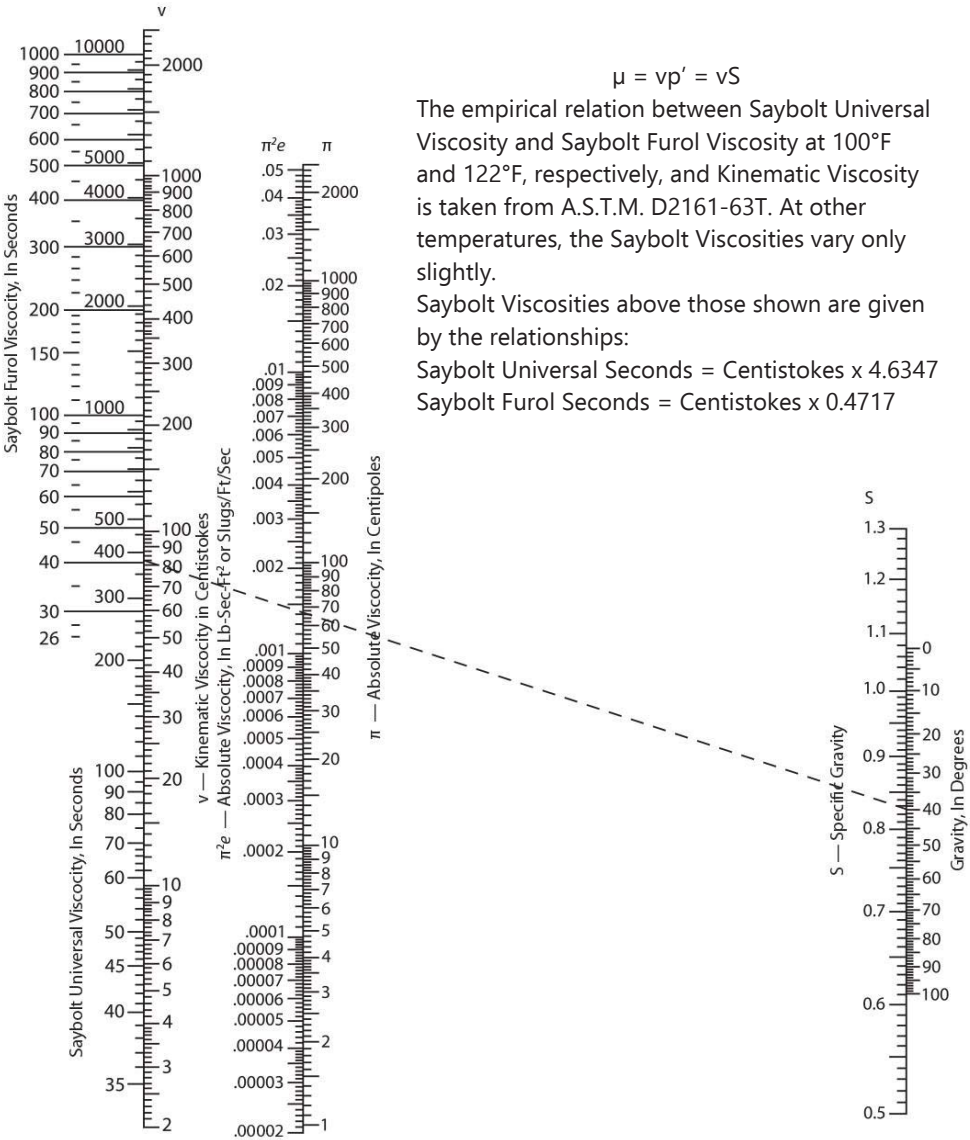


Conversion of Centistokes to Saybolt Universal Seconds

$$\text{centistokes} = \frac{\text{centipoise}}{\text{specific gravity}}$$



Saybolt Furol and Absolute Viscosity



$$\mu = \nu\rho' = \nu S$$

The empirical relation between Saybolt Universal Viscosity and Saybolt Furol Viscosity at 100°F and 122°F, respectively, and Kinematic Viscosity is taken from A.S.T.M. D2161-63T. At other temperatures, the Saybolt Viscosities vary only slightly.

Saybolt Viscosities above those shown are given by the relationships:

Saybolt Universal Seconds = Centistokes x 4.6347

Saybolt Furol Seconds = Centistokes x 0.4717

Example 1

To determine the absolute viscosity of an oil which has a kinematic viscosity of 82 centistokes and a specific gravity of 0.83, connect 82 on the kinematic viscosity scale with 0.83 on the specific gravity scale; read 67 centipoise at the intersection on the absolute viscosity scale.

Example 2

To determine the absolute viscosity of an oil having a specific gravity of 0.83 and a Saybolt Furol viscosity of 40 seconds, connect 0.83 on the specific gravity scale with 40 seconds on the Saybolt Furol scale; read 67 centipoise at the intersection on the absolute viscosity scale.

Viscosity and Gravity of Common Liquids

LIQUID	SPECIFIC GRAVITY	VISCOSITY SSU						
		40°F	60°F	80°F	100°F	120°F	140°F	160°F
TRANSMISSION OILS—AUTO TRANSMISSION GEAR LUBRICANTS								
SAE 90	.880 - .935	14,000	5,500	2,200	1,100	650	380	240
SAE140	.880 - .935	35,000	12,000	5,000	2,200	1,200	650	400
SAE 250	.880 - .935	160,000	50,000	18,000	7,000	3,300	1,700	1,000
OTHER OILS								
Castor Oil	.960	36,000	9,000	3,000	1,400	900	400	300
Chinawood	.943	4,000	1,800	1,000	580	400	300	200
Cocoanut	.925	1,500	500	250	140	100	70	60
Cod	.928	1,800	600	300	175	110	80	70
Corn	.924	1,600	700	400	250	175	100	80
Cotton Seed	.880 - .925	1,500	600	300	176	125	80	70
Cylinder	.820 - .950	60,000	14,000	6,000	2,700	1,400	1,000	400
Navy No. 1 Fuel Oil	.989	4,000	1,100	600	380	200	170	90
Navy No. 2 Fuel Oil	1.000	--	24,000	8,700	3,500	1,500	900	480
Gas	.887	180	90	60	50	45	--	--
Insulating	--	350	150	90	65	50	45	40
Lard	.912 - .925	1,100	600	380	287	180	140	90
Linseed	.925 - .939	1,500	500	250	143	110	85	70
Raw Menhadden	.933	1,500	500	250	140	110	80	70
Neats Foot	.917	--	1,000	430	230	160	100	80
Olive	.912 - .918	1,500	550	320	200	150	100	80
Palm	.924	1,700	700	380	221	160	120	90
Peanut	.920	1,200	500	300	195	150	100	80
Quenching	--	2,400	900	450	250	180	130	90
Rape Seed	.919	2,400	900	450	250	180	130	90
Rosin	.980	28,000	7,800	3,200	1,500	900	500	300
Rosin (Wood)	1.090	Extremely Viscous		Extremely Viscous		Extremely Viscous		
Sesame	.923	1,100	500	290	184	130	90	60
Soya Bean	.927 - .980	1,200	475	270	165	120	80	70
Sperm	.883	360	250	170	110	90	70	60
Turbine (Light)	.910	500	350	230	150	--	--	--
Turbine (Heavy)	.910	3,000	1,400	700	330	200	150	100
Whale	.925	900	450	275	170	140	100	80
MISCELLANEOUS LIQUIDS								
Water	1.00	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Gasoline	.68 - .74	30	30	30	30	30	30	30
Jet Fuel	.74 - .85	35	35	35	35	35	35	35
Kerosene	.78 - .82	42	38	34	33	31	30	30
Turpentine	.86 - .87	34	33	32.8	32.6	32.4	32	32
Varnish Spar	.90	3,500	1,600	1,000	650	530	250	230
CRANKCASE OILS—AUTOMOBILE LUBRICATING OILS								
SAE 10	.88 - .935	1,500-	600-900	300-400	170-220	110-130	75-90	60-65
SAE 20	.88 - .935	2,400-	900-3,000	400-1,100	220-550	130-280	90-170	65-110
SAE 30	.88 - .935	9,000-	3,000-	1,100-	550-800	280-400	170-240	110-150
SAE 40	.88 - .935	14,000-	4,400-	1,800-	800-1,100	400-550	240-320	150-200
SAE 50	.88 - .935	19,000-	6,000-	2,400-	1,100-	550-850	320-480	200-280
SAE 60	.88 - .935	45,000-	10,000-	4,000-	1,800-	850-1,200	480-580	280-380
SAE 70	.88 - .935	60,000-	17,000-	6,000-	2,500-	1,200-	580-900	380-500

Viscosity and Gravity of Common Liquids

LIQUID	SPECIFIC GRAVITY	VISCOSITY SSU						
		40°F	60°F	80°F	100°F	120°F	140°F	160°F
FUEL OIL AND DIESEL OIL								
No. 1 Fuel Oil	.82 - .95	40	38	35	33	31	30	30
No. 2 Fuel Oil	.82 - .95	70	50	45	40	--	--	--
No. 3 Fuel Oil	.82 - _95	90	68	53	45	40	--	--
No. 5A Fuel Oil	.82 - .95	1,000	400	200	100	75	60	40
No. 5B Fuel Oil	.82 - .95	1,300	600	490	400	330	290	240
No. 6 Fuel Oil	.82 - .95	--	70,000	20,000	5,600	1,900	900	500
No. 2D Diesel Fuel Oil	.82 - .95	100	68	53	45	40	36	35
No. 3D Diesel Fuel Oil	.82 - .95	200	120	80	60	50	44	40
No. 4D Diesel Fuel Oil	.82 - .95	1,600	600	280	140	90	68	54
No. 5D Diesel Fuel Oil	.82 - _95	15,000	5,000	2,000	900	400	260	160

LIQUID	SPECIFIC GRAVITY	VISCOSITY SSU		
		70°F	**100°F**	**130°F**
SUGAR, SYRUPS, MOLASSES, ETC.				
Corn Syrups	1.40 - 1.47	--	5,000-500,000	1,500-60,000
Glucose	1.35 - 1.44	--	35,000-100,000	10,000-13,000
Honey (Raw)	--	--	340	
Molasses	1.40 - 1.49	--	1,300-250,000	700-75,000
Corn Starch 22 Baume	1.18	150	130	--
Corn Starch 24 Baume	1.20	600	440	
Corn Starch 25 Baume	1.21	1,400	800	
Ink-Printers	1.00 - 1.38	--	2,500-10,000	1,100-3,000
Ink-Newspapr	--	--	5,500-8,000	2,400
Tallow	.918	56 SSU @ 212°F	56 SSU @ 212°F	
TARS				
Coke Oven-Tar	1.12+	3,000-8,000	650-1,400	--
Gas House-Tar	1.16 - 1.3	15,000-300,000	2,000-20,000	--
CRUDE OILS				
Texas, Oklahoma	.810 - .916	100-700	34-210	--
Wyoming, Montana	.860 - .880	100-1,100	46-320	--
California	.780 - .920	100-4,500	34-700	--
Pennsylvania	.800 - .850	100-200	38-86	--
GLYCOL				
Propylene	1.038	240.6	--	--
Triethylene	1.125	185.7	--	--
Diethylene	1.120	149.7	--	--
Ethylene	1.125	88.4	--	--
Glycerine (100%)	1.260	2,900	813	--
Phenol (Carbolic acid)	.95-1.00	60	--	--
Silicate of Soda	--	--	365-640	--
Sulfuric acid (100%)	1.830	75	--	--

API and &Lune Gravities and Weight Factors

API	Baume	Specific	Lbs. Per	U.S. Gals.
0	10.247	1.0760	8.962	0.1116
1	9.223	1.0679	8.895	0.1124
2	8.198	1.0599	8.828	0.1133
3	7.173	1.0520	8.762	0.1141
4	6.148	1.0443	8.698	0.1150
5	5.124	1.0366	8.634	0.1158
6	4.099	1.0291	8.571	0.1167
7	3.074	1.0217	8.509	0.1175
8	2.049	1.0143	8.448	0.1184
9	1.025	1.0071	8.388	0.1192
10	10.00	1.0000	8.328	0.1201
11	10.99	0.9930	8.270	0.1209
12	11.98	0.9861	8.212	0.1218
13	12.97	0.9792	8.155	0.1226
14	13.96	0.9725	8.099	0.1235
15	14.95	0.9659	8.044	0.1243
16	15.94	0.9593	7.989	0.1252
17	16.93	0.9529	7.935	0.1260
18	17.92	0.9465	7.882	0.1269
19	18.90	0.9402	7.830	0.1277
20	19.89	0.9340	7.778	0.1286
21	20.88	0.9279	7.727	0.1294
22	21.87	0.9218	7.676	0.1303
23	22.86	0.9159	7.627	0.1311
24	23.85	0.9100	7.578	0.1320
25	24.84	0.9042	7.529	0.1328
26	25.83	0.8984	7.481	0.1337
27	26.82	0.8927	7.434	0.1345
28	27.81	0.8871	7.387	0.1354
29	28.80	0.8816	7.341	0.1362
30	29.79	0.8762	7.296	0.1371
31	30.78	0.8708	7.251	0.1379
32	31.77	0.8654	7.206	0.1388
33	32.76	0.8602	7.163	0.1396
34	33.75	0.8550	7.119	0.1405
35	34.73	0.8498	7.076	0.1413
36	35.72	0.8448	7.034	0.1422
37	36.71	0.8398	6.993	0.1430
38	37.70	0.8348	6.951	0.1439
39	38.69	0.8299	6.910	0.1447
40	39.68	0.8251	6.870	0.1456
41	40.67	0.8203	6.830	0.1464
42	41.66	0.8155	6.790	0.1473
43	42_65	0.8109	6.752	0.1481
44	43_64	0.8063	6.713	0.1490
45	44.63	0.8017	6.675	0.1498
46	45.62	0.7972	6.637	0.1507
47	50.61	0.7927	6.600	0.1515
48	50.60	0.7883	6.563	0.1524
49	50.59	0.7839	6.526	0.1532
50	50.58	0.7796	6.490	0.1541

API and Baume Gravities and Weight Factors

API	Baume	Specific	Lbs. Per	U.S. Gals.
51	50.57	0.7753	6.455	0.1549
52	51.55	0.7711	6.420	0.1558
53	52.54	0.7669	6.385	0.1566
54	53.53	0.7628	6.350	0.1575
55	54.52	0.7587	6.316	0.1583
56	55.51	0.7547	6.283	0.1592
57	56.50	0.7507	6.249	0.1600
58	57.49	0.7467	6.216	0.1609
59	58.48	0.7428	6.184	0.1617
60	59.47	0.7389	6.151	0.1626
61	60.46	0.7351	6.119	0.1634
62	61.45	0.7313	6.087	0.1643
63	62.44	0.7275	6.056	0.1651
64	63.43	0.7238	6.025	0.1660
65	64.42	0.7201	5.994	0.1668
66	65.41	0.7165	5.964	0.1677
67	66.40	0_7128	5.934	0.1685
68	67.39	0.7093	5.904	0.1694
69	68.37	0.7057	5.874	0.1702
70	69.36	0.7022	5.845	0.1711
71	70.35	0.6988	5.817	0.1719
72	71.34	0.6953	5.788	0.1728
73	72.33	0.6919	5.759	0.1736
74	73.32	0.6886	5.731	0.1745
75	74.31	0.6852	5.703	0.1753
76	75.30	0.6819	5.676	0.1762
77	76.29	0.6787	5.649	0.1770
78	.77.28	0.6754	5.622	0.1779
79	78.27	0.6722	5.595	0.1787
80	79.26	0.6690	5.568	0.1796
81	80.25	0.6659	5.542	0.1804
82	81.24	0.6628	5.516	0.1813
83	82.23	0.6597	5.491	0.1821
84	83.22	0.6566	5.465	0.1830
85	84.20	0.6536	5.440	0.1838
86	85.19	0.6506	5.415	0.1847
87	86.18	0.6476	5.390	0.1855
88	87.17	0.6446	5.365	0.1864
89	88.16	0.6417	5.341	0.1872
90	89.15	0.6388	5.316	0.1881
91	90.14	0.6360	5.293	0.1889
92	91.13	0.6331	5.269	0.1898
93	92.12	0.6303	5.246	0.1906
94	93.11	0.6275	5.222	0.1915
95	94.10	0.6247	5.199	0.1924
96	95.09	0.6220	5.176	0.1932
97	96.08	0.6193	5.154	0.1940
98	97.07	0.6166	5.131	0.1949
99	98.06	0.6139	5.109	0.1957
100	99.05	0.6112	5.086	0.1966

NOTES—

The relation of Degrees Baume or API to Specific Gravity is expressed by the following formulas:

For liquids lighter than water:

$$\text{Degrees Baume} = \frac{140}{\text{G}} - 130 \quad G = \frac{140}{130 + \text{Degrees Baume}}$$

$$\text{Degrees API} = \frac{141.5}{\text{G}} - 131.5 \quad G = \frac{141.5}{131.5 + \text{Degrees API}}$$

For liquids heavier than water:

$$\text{Degrees Baume} = 145 - \frac{145}{\text{G}} \quad G = \frac{145}{145 + \text{Degrees Baume}}$$

G = Specific Gravity = ratio of the weight of a given volume of oil at 60° Fahrenheit to the weight of the same volume of water at 60° Fahrenheit.

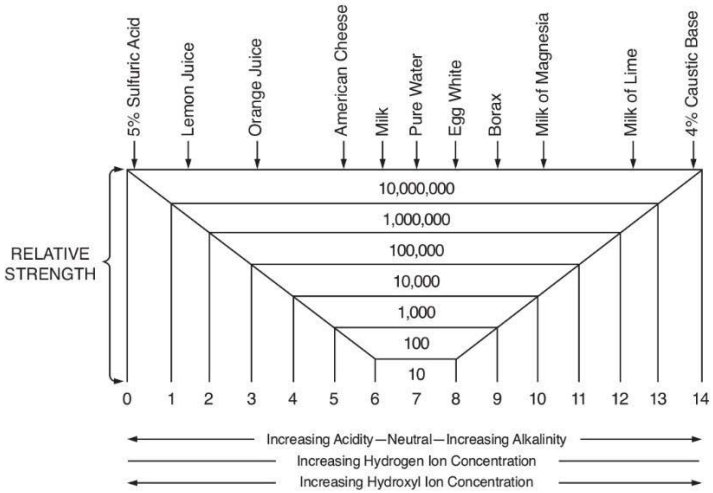
The above tables are based on the weight of 1 gallon (U.S.) of oil with a volume of 231 cubic inches at 60° Fahrenheit in air at 760 mm pressure and 50% humidity. Assumed weight of 1 gallon of water at 60° Fahrenheit in air is 8.32828 pounds.

$$\text{D} = \frac{\text{m}d_1 + \text{n}d_2}{\text{m} + \text{n}}$$

D = Density or Specific Gravity of mixture
m = Proportion of oil of d_1 density
n = Proportion of oil of d_2 density
d_1 = Specific gravity of m oil
d_2 = Specific Gravity of n oil

To determine the resulting gravity by mixing oils of different gravities:

pH Scale



The pH Scale

In its simplest definition, pH can be delined as a measure of the acidity or alkalinity of a substance, For instance, lemon juice is acid and lye is alkaline, The pH scale is used to express the degree.

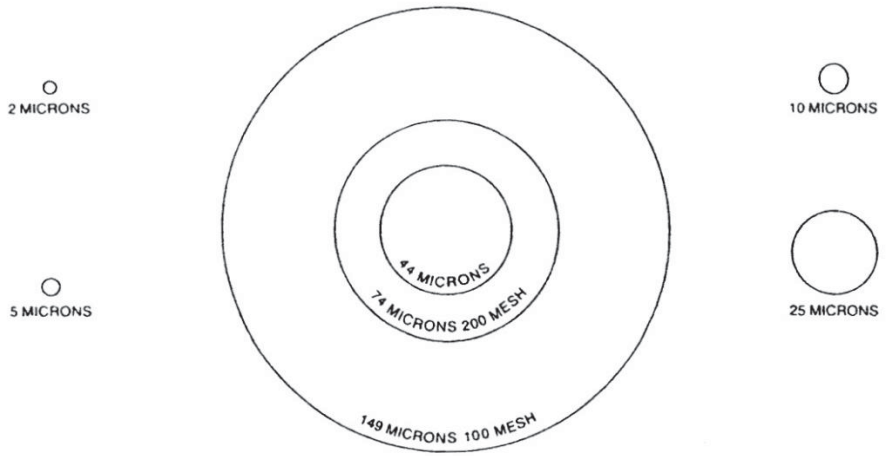
There are many hundreds of acids and alkalies of varying strength. Despite their widely diverse properties, acids owe their acidity to the single property of actively producing dissociated, or tree, hydrogen ions (H +) in solution; while alkalies owe their alkalinity to the property of actively producing dissociated hydroxyt ions (OH—) in solution. However, all acid substances have some hydroxyl ions, just as all alkaline substances have some hydrogen ions, and the product of the two ions in solution is always a constant. Therefore, it is possible to express the concentration of one ion relative to the other, rather than have a separate scale for each.

Hydrogen ion concentration is used to express both acidity and alkalinity, since an electrode that will sense hydrogen ion concentration is much more stable than one which will sense hydroxyl ion concentration. Because numerical values for the hydrogen ion concentration often are extremely small fractions (for example, 1/10,000,000), the pH scale is used instead. This scale is defined as the negative logarithm (or the log of the reciprocal) of the hydrogen ion concentration. The arbitrary term, pH, is simply a logarithmic index employing small numbers to express hydrogen ion concentration.

The pH scale ranges from 0 to 14, with 7 (the pH of pure water) the neutral point at which hydrogen ions and hydroxyl ions exist at about the same concentration. Numbers greater than 7 indicate the degree of alkalinity, and numbers less than 7 indicate the degree of acidity. The relationship between the two ions and acidity and alkalinity is shown above. Note that the relative strength of acids and alkalies changes tenfold for each unit change in pH. Thus, compared with a solution of pH5, a solution of pH4 is ten times as acid, a solution of pH3 is a hundred limes as acid, and a solution of pH2 is one thousand times as acid.

Particles, Relative Size

MAGNIFICATION: 500 TIMES



LINEAR EQUIVALENTS

1 inch	25.4 Millimeters	2,400 Microns
1 millimeter	.0394 Inches	1,000 Microns
1 Micron	1/25,400 of an inch	001 Millimeters
1 Micron	3.94×10^{-5}	.000039 Inches

RELATIVE SIZES

Lower Limit of Visibility (Naked Eye)	40 Microns
White Blood Cells	25 Microns
Red Blood Cells	8 Microns
Bacteria (Cocci)	2 Microns

STANDARD SCREEN SIZES

Meshes per	ASTM-E-11-61	Opening in	Opening in
20.16	20	0.0331	841
27.62	30	0.0234	595
38.02	40	0.0165	420
52.36	50	0.0117	297
72.45	70	0.0083	210
85.47	80	0.0070	177
101.1	100	0.0059	149
142.86	140	0.0041	105
200.00	200	0.0029	74
270.26	270	0.0021	53
323.00	325	0.0017	44

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