

Combustion Properties of Commercial Fuel Gases - Air/Gas Ratio, Flammability Limits, Ignition Temp. & Flame Velocity

No.	Gas	Stoichiometric Air/Gas Ratio		Limits of Flammability % Gas in Air/Gas Mixture		Min. Ignition Temp. in Air, °F	Max. Flame Velocity in Air, Ft/Sec
		Cu Ft Air/ Cu Ft Gas	Lb Air/ Lb Gas	Lean	Rich		
1	Acetylene	11.91	13.26	2.5	80	581	9.4
2	Blast Furnace Gas	0.68	0.67	45	72	-	-
3	Butane (natural gas)	30.47	15.63	1.86	8.41	826	2.8
4	Butylene (Butene)	28.59	14.77	1.7	9	829	3.2
5	Carbon Monoxide	2.38	2.46	12	74	1,128	2.0
6	Carburetted Water Gas	4.60	7.36	4.2	42.9	-	-
7	Coke Oven Gas	4.99	11.27	4.5	31.5	-	-
8	Digester (Sewage) Gas	6.41	7.97	8	17	-	-
9	Ethane	16.68	15.98	3.15	12.8	882	2.8
10	Hydrogen	2.38	33.79	4	74.2	1,065	16.0
11	Methane	9.53	17.23	5	15	1,170	2.2
12	Natural (Birmingham, AL)	9.41	15.68	7.03	15.77	-	-
13	Natural (Pittsburgh, PA)	10.58	17.31	4.6	14.7	-	-
14	Natural (Los Angeles, CA)	10.05	14.26	4.9	15.6	-	-
15	Natural (Kansas City, MO)	9.13	14.59	5.4	16.3	-	-
16	Natural (Groningen, Netherlands)	8.41	13.45	6.1	15	1,238	1.18
17	Natural (Midlands Grid, U.K.)	9.8	16.13	5	15	1,300	0.98
18	Producer (Wellman-Galusha)	1.30	1.56	16.4	69.4	-	-
19	Propane (natural gas)	23.82	15.73	2.37	9.50	898	2.7
20	Propylene (Propene)	21.44	14.77	2	11.1	856	3.3
21	Sasol (South Africa)	4.13	9.84	5.3	37.4	-	-
22	Water Gas (bituminous)	2.01	2.86	8.9	61	-	-

Heating Value, Heat Release & Flame Temperature

No.	Gas	Heating Value				Heat Release, Btu		Theoretical Flame Temperature
		Btu/cu ft		Btu/lb		Per Cu Ft Air	Per Lb Air	°F
		Gross	Net	Gross	Net			
1	Acetylene	1,498	1,447	21,569	20,837	125.8	1,677	4,250
2	Blast Furnace Gas	92	92	1,178	1,178	135.3	1,804	2,650
3	Butane (natural gas)	3,225	2,977	21,640	19,976	105.8	1,411	3,640
4	Butylene (Butene)	3,077	2,876	20,780	19,420	107.6	1,435	3,810
5	Carbon Monoxide	323	323	4,368	4,368	135.7	1,809	3,960
6	Carburetted Water Gas	550	508	11,440	10,566	119.6	1,595	3,725
7	Coke Oven Gas	574	514	17,048	15,266	115.0	1,533	3,610
8	Digester (Sewage) Gas	690	621	11,316	10,184	107.6	1,407	3,550
9	Ethane	1,783	1,630	22,198	20,295	106.9	1,425	3,710
10	Hydrogen	325	275	61,084	51,628	136.6	1,821	3,960
11	Methane	1,011	910	23,811	21,433	106.1	1,415	3,640
12	Natural (Birmingham, AL)	1,002	904	21,844	19,707	106.5	1,420	3,565
13	Natural (Pittsburgh, PA)	1,129	1,021	24,161	21,849	106.7	1,423	3,562
14	Natural (Los Angeles, CA)	1,073	971	20,065	18,158	106.8	1,424	3,550
15	Natural (Kansas City, MO)	974	879	20,259	18,283	106.7	1,423	3,535
16	Natural (Groningen, Netherlands)	941	849	19,599	17,678	111.9	1,492	3,380
17	Natural (Midlands Grid, U.K.)	1,035	902	22,500	19,609	105.6	1,408	3,450
18	Producer (Wellman-Galusha)	167	156	2,650	2,476	128.5	1,713	3,200
19	Propane (natural gas)	2,572	2,365	21,500	19,770	108.1	1,440	3,660
20	Propylene (Propene)	2,322	2,181	20,990	19,630	108.8	1,451	3,830
21	Sasol (South Africa)	500	443	14,550	13,016	116.3	1,551	3,452
22	Water Gas (bituminous)	261	239	4,881	4,469	129.9	1,732	3,510

Combustion Products and % CO₂

No.	Gas	Combustion Products Cu Ft/Cu Ft Gas				Combustion Products Lb/Lb Gas				Ultimate
		CO ₂	H ₂ O	N ₂	Total	CO ₂	H ₂ O	N ₂	Total	CO ₂ % *
1	Acetylene	2.00	1.00	9.41	12.41	3.38	0.69	10.19	14.26	17.5
2	Blast Furnace Gas	0.39	0.02	1.14	1.54	.59	0	1.08	1.67	25.5
3	Butane (natural gas)	3.93	4.93	24.07	32.93	3.09	1.59	11.95	16.63	14.0
4	Butylene (Butene)	4.00	4.00	22.59	30.59	3.14	1.29	11.34	15.77	15.0
5	Carbon Monoxide	1.00	0	1.88	2.88	1.57	0	1.89	3.46	34.7
6	Carburetted Water Gas	0.76	0.87	3.66	5.29	1.85	0.87	5.64	8.36	17.2
7	Coke Oven Gas	0.51	1.25	4.02	5.78	1.76	1.76	8.75	12.27	11.2
8	Digester (Sewage) Gas	0.92	1.42	5.44	7.78	1.74	1.10	6.53	9.37	14.5
9	Ethane	2.00	3.00	13.18	18.18	2.93	1.8	12.25	16.98	13.2
10	Hydrogen	0	1.00	1.88	2.88	0	8.89	25.90	34.79	0
11	Methane	1.00	2.00	7.53	10.53	2.75	2.25	13.23	18.23	11.7
12	Natural (Birmingham, AL)	1.00	2.02	7.48	10.50	2.54	2.11	12.03	16.68	11.8
13	Natural (Pittsburgh, PA)	1.15	2.22	8.37	11.73	2.86	2.27	13.18	18.31	12.1
14	Natural (Los Angeles, CA)	1.16	2.10	7.94	11.20	2.51	1.87	10.88	15.26	12.7
15	Natural (Kansas City, MO)	0.98	1.95	7.30	10.23	2.39	1.95	11.25	15.59	11.9
16	Natural (Groningen, Netherlands)	0.89	1.73	6.74	9.36	2.17	1.73	10.45	14.35	11.7
17	Natural (Midlands Grid, U.K.)	1.05	2.19	7.94	11.78	2.67	2.29	12.84	17.80	11.7
18	Producer (Wellman-Galusha)	0.34	0.17	1.59	2.11	0.61	0.13	1.82	2.56	17.6
19	Propane (natural gas)	3.00	4.17	18.82	25.99	3.00	1.70	12.03	16.73	13.7
20	Propylene (Propene)	3.00	3.00	16.94	22.94	3.14	1.29	11.34	15.77	15.0
21	Sasol (South Africa)	0.48	1.00	3.28	4.76	1.76	1.50	7.63	10.89	12.8
22	Water Gas (bituminous)	0.41	0.47	1.86	2.74	0.89	0.42	2.55	3.86	18.0