

PROPERTY EQUIVALENTS OF GASES

	MASS			VOLUME			HEAT OF VAPORIZATION	
	TONS	POUNDS	KILOGRAMS	FT ³ (NTP) GAS	LITERS LIQ. (nbp)	GALLONS LIQ. (nbp)	BTU	KILOGRAM CALORIES
HELIUM He	1	2000	907.2	1.934x10 ⁵	7263.	1919.	1.74x10 ⁴	4.39x10 ³
	0.0005	1	0.4536	96.71	3.631	0.9593	8.72	2.20
	0.0011023	2.205	1	213.2	8.006	2.115	19.2	4.84
	5.17x10 ⁻⁶	0.01034	0.004690	1	0.03755	0.009919	0.0902	0.0227
	1.377x10 ⁻⁴	0.2754	0.1249	26.63	1	0.2642	2.40	0.605
	5.212x10 ⁻⁴	1.042	0.4728	100.8	3.785	1	9.09	2.29
20.4 °K equilibrium-HYDROGEN e-H ₂	1	2000	907.2	3.840x10 ⁵	1.282x10 ⁴	3386.	3.86x10 ⁵	9.73x10 ⁴
	0.0005	1	0.4536	192.0	6.409	1.693	193	48.6
	0.0011023	2.205	1	423.2	14.13	3.733	425	107.
	2.604x10 ⁻⁶	0.005209	0.002363	1	0.03339	0.008820	1.01	0.253
	7.801x10 ⁻⁵	0.1560	0.07077	29.95	1	0.2642	30.1	7.59
	2.953x10 ⁻⁴	0.5906	0.2679	113.4	3.785	1	114.	28.7
normal-HYDROGEN n-H ₂	1	2000	907.2	3.840x10 ⁵	1.279x10 ⁴	3379.	3.84x10 ⁵	9.68x10 ⁴
	0.0005	1	0.4536	192.0	6.395	1.689	192.	48.4
	0.0011023	2.205	1	423.2	14.10	3.724	423.	107.
	2.604x10 ⁻⁶	0.005209	0.002363	1	0.03331	0.008800	1.00	0.252
	7.819x10 ⁻⁵	0.1564	0.07093	30.02	1	0.2642	30.0	7.57
	2.960x10 ⁻⁴	0.5919	0.2685	113.6	3.785	1	114.	28.6
NITROGEN N ₂	1	2000	907.2	2.761x10 ⁴	1122.	296.5	1.71x10 ⁵	4.32x10 ⁴
	0.0005	1	0.4536	13.80	0.5612	0.1482	85.7	21.6
	0.0011023	2.205	1	30.43	1.237	0.3268	189.	47.6
	3.622x10 ⁻⁵	0.07245	0.03286	1	0.04066	0.01074	6.21	1.56
	8.910x10 ⁻⁴	1.782	0.8083	24.60	1	0.2642	153.	38.5
	0.003373	6.746	3.060	93.11	3.785	1	578.	146.
AIR	1	2000	907.2	2.669x10 ⁴	1038.	274.2	1.76x10 ⁵	4.45x10 ⁴
	0.0005	1	0.4536	13.35	0.5190	0.1371	88.2	22.2
	0.0011023	2.205	1	29.42	1.144	0.3023	194.	49.0
	3.746x10 ⁻⁵	0.07493	0.03399	1	0.03889	0.01027	6.61	1.67
	9.634x10 ⁻⁴	1.927	0.8740	25.71	1	0.2642	170.	42.8
	0.003647	7.294	3.308	97.34	3.785	1	643.	162.
ARGON Ar	1	2000	907.2	1.934x10 ⁴	651.1	172.0	1.40x10 ⁵	3.54x10 ⁴
	0.0005	1	0.4536	9.671	0.3256	0.08600	70.2	17.7
	0.0011023	2.205	1	21.32	0.7177	0.1896	155.	39.0
	5.170x10 ⁻⁵	0.1034	0.04690	1	0.03366	0.008893	7.26	1.83
	0.001536	3.072	1.393	29.71	1	0.2642	216.	54.3
	0.005814	11.63	5.274	112.5	3.785	1	816.	206.
OXYGEN O ₂	1	2000	907.2	2.415x10 ⁴	794.6	209.9	1.83x10 ⁵	4.62x10 ⁴
	0.0005	1	0.4536	12.08	0.3973	0.1050	91.7	23.1
	0.0011023	2.205	1	26.62	0.8759	0.2314	202.	50.9
	4.140x10 ⁻⁵	0.08281	0.03756	1	0.03290	0.008692	7.59	1.91
	0.001258	2.517	1.142	30.39	1	0.2642	231.	58.2
	0.004764	9.527	4.322	115.1	3.785	1	874.	220.
METHANE CH ₄	1	2000	907.2	4.81x10 ⁴	2.14x10 ³	565.	4.38x10 ⁵	1.10x10 ⁵
	0.0005	1	0.4536	24.0	1.07	0.282	219.	55.2
	0.0011023	2.205	1	53.0	2.36	0.622	483.	122.
	2.08x10 ⁻⁵	0.0416	0.0189	1	0.0445	0.0117	9.11	2.30
	4.68x10 ⁻⁴	0.936	0.424	22.5	1	0.2642	205.	51.6
	0.00177	3.54	1.61	85.2	3.785	1	776.	196.

EQUIVALENT TEMPERATURES OF GASES

	NORMAL BOILING POINT	MELTING POINT		NORMAL BOILING POINT	MELTING POINT
He	4.2 °K -268.9 °C 7.6 °R -452.1 °F		Ar	87.3 °K -185.9 °C 157.1 °R -302.6 °F	83.8 °K -189.4 °C 150.8 °R -308.9 °F
e-H ₂	20.3 °K -252.9 °C 36.5 °R -423.2 °F	13.8 °K -259.3 °C 24.9 °R -434.8 °F	O ₂	90.2 °K -183.0 °C 162.3 °R -297.3 °F	54.4 °K -218.8 °C 97.9 °R -361.8 °F
n-H ₂	20.4 °K -252.8 °C 36.7 °R -423.0 °F	14.0 °K -259.2 °C 25.2 °R -434.5 °F	CH ₄	111.7 °K -161.5 °C 201.0 °R -258.7 °F	90.7 °K -182.5 °C 163.2 °R -296.4 °F
N ₂	77.4 °K -195.8 °C 139.3 °R -320.4 °F	63.2 °K -210.0 °C 113.7 °R -346.0 °F	NH ₃	239.7 °K -33.4 °C 431.5 °R -28.2 °F	195.4 °K -77.7 °C 351.7 °R -107.9 °F*

*Triple point used

CONVERSION FACTORS

VOLUME	CUBIC FEET	CUBIC METERS	U.S. GALLONS	LITERS
CUBIC FEET	1	0.028317	7.4805	28.317
CUBIC METERS	35.315	1	264.17	1000.0
U.S. GALLONS	0.13368	0.0037854	1	3.7854
LITERS	0.035315	0.0010000	0.26417	1

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CRYOGENIC PROPERTIES OF GASES

GAS		He	e-H ₂	n-H ₂	N ₂	AIR	Ar	O ₂	CH ₄
ATOMIC OR MOLECULAR WEIGHT		4.0026	2.0159	2.0159	28.013	28.96	39.948	31.999	16.043
NORMAL BOILING POINT (nbp)	° F	-452.1	-423.2	-423.0	-320.4	-317.8 to -312.4	-302.6	-297.3	-258.7
TRIPLE POINT (tp)	° F		-434.8	-434.6	-346.0		-308.9	-361.8	-296.5
	PSIA		1.02	1.04	1.8		10.0	0.022	1.7
CRITICAL POINT	° F	-450.3	-400.3	-399.9	-232.5	-221.3	-188.1	-181.1	-115.8
	PSIA	33.2	187.7	188.1	493.	547.	710.	737.	673.
DENSITY	GAS, NTP	LB/FT ³	0.01034	0.005209	0.005209	0.07493	0.1034	0.08281	0.0416
	GAS, STP	LB/FT ³	0.01114	0.005611	0.005611	0.08072	0.1114	0.08921	0.0448
	VAPOR, nbp	LB/FT ³	1.04	0.0835	0.0831	0.280	0.363	0.279	0.114
	LIQUID, nbp	LB/FT ³	7.798	4.418	4.428	54.56	86.98	71.27	26.5
SPECIFIC HEAT, Cp, GAS, NTP	BTU/LB. ° F	1.25	3.56	3.42	0.247	0.240	0.125	0.220	0.533
SPECIFIC HEAT RATIO, Cp/Cv, GAS, NTP		1.66	1.38	1.41	1.41	1.40	1.67	1.40	1.31
HEAT OF VAPORIZATION, nbp	BTU/LB.	8.72	193.	192.	85.7	88.2	70.2	91.7	219
HEAT OF FUSION, tp	BTU/LB.		25.0	25.0	11.1		12.7	6.0	25.2

NTP= 70 °F & 14.70 PSIA STP= 32 °F & 14.70 PSIA