

Sheet1

0 °C corresponds to 32 °F, 273.16 K and 491.69
 NTP - Normal Temperature and Pressure - is defined
 density of air defined <http://hypertextbook.com/facts/>

1.25 kg/m³

Temp K.	Temp F.	Temp. Celsius	sat. vapor density gm/m ³
238.16	-31	-35	
239.16	-29.2	-34	
240.16	-27.4	-33	
241.16	-25.6	-32	
242.16	-23.8	-31	
243.16	-22	-30	
244.16	-20.2	-29	
245.16	-18.4	-28	
246.16	-16.6	-27	
247.16	-14.8	-26	
248.16	-13	-25	
249.16	-11.2	-24	
250.16	-9.4	-23	
251.16	-7.6	-22	
252.16	-5.8	-21	
253.16	-4	-20	
254.16	-2.2	-19	
255.16	-0.4	-18	
256.16	1.4	-17	
257.16	3.2	-16	
258.16	5	-15	
259.16	6.8	-14	
260.16	8.6	-13	
261.16	10.4	-12	
262.16	12.2	-11	
263.16	14	-10	2.36
264.16	15.8	-9	
265.16	17.6	-8	

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266.16	19.4	-7	
267.16	21.2	-6	
268.16	23	-5	
269.16	24.8	-4	
270.16	26.6	-3	
271.16	28.4	-2	
272.16	30.2	-1	
273.16	32	0	4.85
274.16	33.8	1	
275.16	35.6	2	
276.16	37.4	3	
277.16	39.2	4	
278.16	41	5	6.8
279.16	42.8	6	
280.16	44.6	7	
281.16	46.4	8	
282.16	48.2	9	
283.16	50	10	9.4
284.16	51.8	11	10.01
285.16	53.6	12	10.66
286.16	55.4	13	11.35
287.16	57.2	14	12.07
288.16	59	15	12.83
289.16	60.8	16	
290.16	62.6	17	
291.16	64.4	18	
292.16	66.2	19	
293.16	68	20	17.3
294.16	69.8	21	
295.16	71.6	22	
296.16	73.4	23	
297.16	75.2	24	
298.16	77	25	23
299.16	78.8	26	
300.16	80.6	27	
301.16	82.4	28	
302.16	84.2	29	
303.16	86	30	30.4

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304.16	87.8	31	
305.16	89.6	32	
306.16	91.4	33	
307.16	93.2	34	
308.16	95	35	
309.16	96.8	36	
310.16	98.6	37	44
311.16	100.4	38	
312.16	102.2	39	
313.16	104	40	51.1
Temp F.	Temp. Celsius	(1) values above 1	

1 bar 1000 mb 100,000Pa 1mb = 100Pa or 1HPa

1 m³ at 1atm at 0C = 44.6175159318548 Moles. <http://www.chen>

1 m³ at 760mmHg at 0C = 44.6175159318548 Moles. <http://www>

1 m³ at 14.6959487755099 psi at 0C = 44.6175159318548 Mole

1 m³ at 101325Pa at 0C = 44.6175159318548 Moles. <http://www>

PV=nRT n=PV/RT R=PV/Tn

0C

25C

50C

75C

100C

-100C

http://en.wikipedia.org/wiki/Gas_constant 8.314472

also <http://physics.nist.gov/cgi-bin/cuu/Value?r>|search_for=gas+c

1 liter = .001 m³ 0.001 meters³

1molar volume 22.414 liters

1molar volume = 22.414 liters. 0.022414 meters³

273.16 6.109713 -2.211975

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R from: http://www.engineeringtoolbox.com/unit-converter-d_185.html

defined as air at 20°C (293.15 K, 68°F) and 1 atm (101.325 kN/m², 101.325 kPa, 14.7 psia, 0 psig, 30 in Hg, 760 mm Hg)
 density of dry air at 20°C and 101.325 kPa using 1.25 kg/m³

Saturated Water Vapor Pressure in mb e_s

density of dry air 0°C & 760mm

$$e_s = 6.112 \cdot \exp(17.87 \cdot B62 / (B62 + 243.5))$$

Bolton (1980) (0.3% within -35°C to 35°C)

$$e_s = 6.112 \exp\left(\frac{17.87}{T_c + 243.5}\right)$$

(1)

goff equation saturation pressure of water vapor

hPA mb = 100PA

Pa

Moles.

hPA mb

$$pws = e^{(77.3450 + 0.0057 T - 7.235 / T) / T^{8.2}}$$

0.315013	0.314764	31.363498	0.015839
0.347513	0.347347	34.605369	0.017403
0.383019	0.382945	38.147434	0.019104
0.421775	0.421801	42.014115	0.020953
0.464043	0.464178	46.231532	0.022962
0.510102	0.510354	50.827593	0.02514
0.56025	0.560628	55.832095	0.027503
0.614806	0.615318	61.276829	0.030062
0.674109	0.674762	67.195689	0.032831
0.73852	0.739322	73.624777	0.035827
0.808424	0.809381	80.602525	0.039064
0.884231	0.885349	88.169812	0.042561
0.966376	0.967659	96.370092	0.046333
1.055321	1.056773	105.249517	0.050401
1.151556	1.15318	114.857075	0.054783
1.255603	1.2574	125.244727	0.059502
1.368012	1.369982	136.46755	0.064578
1.489368	1.491509	148.58388	0.070036
1.620291	1.622599	161.655471	0.0759
1.761434	1.763903	175.747646	0.082196
1.913489	1.916111	190.929462	0.088951
2.077188	2.079954	207.273874	0.096193
2.253302	2.256199	224.857906	0.103952
2.442646	2.445659	243.762831	0.11226
2.646079	2.64919	264.074345	0.12115
2.864507	2.867696	285.882762	0.130657
3.098881	3.102126	309.283195	0.140817
3.350208	3.353482	334.375762	0.151667

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3.619541	3.622817	361.265778	0.163249
3.907992	3.911238	390.063967	0.175602
4.216727	4.21991	420.886668	0.188772
4.54697	4.550055	453.856056	0.202802
4.900009	4.902956	489.100359	0.217742
5.277192	5.279961	526.754084	0.23364
5.679932	5.682482	566.95825	0.250549
6.109713	6.112	609.860618	0.268521
6.568087	6.570067	655.615939	0.287614
7.056678	7.058307	704.386193	0.307887
7.577186	7.57842	756.340841	0.329399
8.131388	8.132186	811.65708	0.352215
8.721143	8.721465	870.520101	0.3764
9.348392	9.348201	933.123353	0.402023
10.015161	10.014425	999.668813	0.429156
10.723564	10.722257	1070.367257	0.457873
11.475807	11.473911	1145.438537	0.488249
12.274191	12.271696	1225.111862	0.520366
13.121112	13.11802	1309.626088	0.554306
14.019066	14.015393	1399.230002	0.590155
14.970652	14.966429	1494.182618	0.628001
15.978576	15.973851	1594.753476	0.667936
17.04565	17.040495	1701.222943	0.710056
18.1748	18.169308	1813.882516	0.75446
19.369066	19.363361	1933.035134	0.801249
20.631604	20.62584	2058.99549	0.850529
21.965696	21.960063	2192.090342	0.902408
23.374744	23.369471	2332.658841	0.957
24.862278	24.857641	2481.052843	1.01442
26.431961	26.428285	2637.637242	1.074788
28.087588	28.085254	2802.790292	1.138229
29.833092	29.832543	2976.903943	1.204869
31.672548	31.674294	3160.384168	1.27484
33.610172	33.614801	3353.651305	1.348279
35.650331	35.658512	3557.140389	1.425324
37.797541	37.810033	3771.301497	1.506119
40.056471	40.074135	3996.600084	1.590813
42.431951	42.455754	4233.517331	1.679557

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44.928969	44.959999	4482.550491	1.772509
47.552679	47.592151	4744.213231	1.869829
50.308402	50.357672	5019.035982	1.971683
53.201633	53.262207	5307.566291	2.078242
56.23804	56.31159	5610.369168	2.189679
59.42347	59.511843	5928.027435	2.306175
62.763952	62.869188	6261.142082	2.427913
66.2657	66.390045	6610.332616	2.555082
69.935118	70.08104	6976.237412	2.687877
73.778803	73.949006	7359.51407	2.826495

from: <http://hyperphysics.phy-astr.gsu.edu/hbase/Kinetic/watvap.html#c1>

equation above from <http://hurri.kean.edu/~yoh/calculations/mc>

$$pws = e^{(77.3450 + 0.0057 T - 7,235 / T) / T8.2 (1)}$$

equation above from <http://www.engir>

chemicool.com/cgi-bin/gaslaws.pl

www.chemicool.com/cgi-bin/gaslaws.pl

as. <http://www.chemicool.com/cgi-bin/gaslaws.pl>

www.chemicool.com/cgi-bin/gaslaws.pl

8.313696 Pa*m³*K⁻¹*moles⁻¹

8.313721

8.313743

8.313761

8.313777

8.31352

constant

molar mass of air in grams/mole

water in grams/mole

28.57

18.02

0.640368

0.4039

0.000015

-0.007704

3.005715

0.786021

torr)

http://www.engineeringtoolbox.com/specific-gravities-gases-d_334.html

Saturated vapor density vs Temp C

$$VD = 6.335 + .6718T_C - 2.0887 \times 10^{-2}T_C^2 + 7.3095 \times 10^{-4}T_C^3$$

$\left(\frac{.67T_C}{-243.5} \right)$		3.5/(B7+253)		sat. vapor density	density of dry
grams. 18.02g/Mole		gr/m ³		gm/m ³	kg/m3
					273.15/(C10+273.15)
0.285414	-74.104056	0.015982			1.433708
0.313599	-69.380831	0.015909			1.427713
0.344259		0.015837			1.421768
0.377581		0.015766			1.415872
0.413767		0.015695			1.410025
0.453031		0.015625			1.404226
0.495598		0.015556			1.398474
0.54171		0.015487			1.39277
0.591622		0.015419			1.387112
0.645604		0.015351			1.381499
0.703942		0.015284			1.375932
0.766941		0.015217			1.370409
0.834919		0.015152			1.364931
0.908217		0.015086			1.359496
0.987192		0.015021			1.354105
1.072221	-21.3034	0.014957			1.348756
1.163703		0.014894			1.343449
1.262058		0.014831			1.338183
1.367726		0.014768			1.332959
1.481174		0.014706			1.327776
1.602891		0.014644			1.322632
1.733392		0.014583			1.317528
1.873216		0.014523			1.312464
2.02293		0.014463			1.307438
2.183131		0.014403			1.302451
2.354443	-2.822007	0.014344		2.36	1.297501
2.537519		0.014286			1.292589
2.733046		0.014228			1.287715

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2.941739		0.01417		1.282876
3.16435		0.014113		1.278074
3.401663		0.014056		1.273308
3.654498		0.014		1.268577
3.923711		0.013944		1.263881
4.210197		0.013889		1.25922
4.514887		0.013834		1.254593
4.838755	6.335	0.01378	4.85	1.25
5.182813		0.013725		1.24544
5.548117		0.013672		1.240914
5.935768		0.013619		1.23642
6.346907		0.013566		1.231959
6.782725		0.013514	6.8	1.22753
7.244459		0.013462		1.223133
7.733394		0.01341		1.218767
8.250863		0.013359		1.214432
8.798253		0.013308		1.210128
9.377001		0.013258	9.4	1.205854
9.988597		0.013208	10.01	1.20161
10.634587		0.013158	10.66	1.197396
11.316571		0.013109	11.35	1.193212
12.036209		0.01306	12.07	1.189056
12.795217		0.013011	12.83	1.18493
13.595371		0.012963		1.180832
14.438508		0.012915		1.176762
15.326528		0.012868		1.17272
16.261395		0.012821		1.168706
17.245136		0.012774	17.3	1.164719
18.279845	18.000961	0.012727		1.16076
19.367683		0.012681		1.156827
20.510881		0.012635		1.152921
21.711738		0.01259		1.149041
22.972624		0.012545	23	1.145187
24.295984		0.0125		1.141359
25.684334		0.012456		1.137556
27.140265		0.012411		1.133779
28.666445		0.012367		1.130026
30.265619	43.397434	0.012324	30.4	1.126299

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31.94061	0.012281		1.122596
33.694321	0.012238		1.118917
35.529735	0.012195		1.115262
37.449919	0.012153		1.111631
39.45802	0.012111		1.108024
41.557271			1.10444
43.75099		44	1.100879
46.042581			1.097341
48.435536			1.093825
50.933435		51.1	1.090332

[disture/Equations/moist.html](#)

$$77.3450 + 0.0057 T - 7,235 / T) / T^{8.2}$$

[eeringtoolbox.com/water-vapor-saturation-pressure-air-d_689.html](#)

6.109713

air.

change in density from 0C

	Moles/M ³	Temp. Celsius	Temp F.
273.15)*\$B\$5			
183.707747	49.489394	-35	-31
177.712733	49.282455	-34	-29.2
171.767645	49.07724	-33	-27.4
165.871864	48.873727	-32	-25.6
160.024778	48.671894	-31	-23.8
154.225787	48.471722	-30	-22
148.474299	48.273189	-29	-20.2
142.769733	48.076277	-28	-18.4
137.111517	47.880964	-27	-16.6
131.49909	47.687231	-26	-14.8
125.931896	47.49506	-25	-13
120.409392	47.304432	-24	-11.2
114.931041	47.115328	-23	-9.4
109.496317	46.927729	-22	-7.6
104.1047	46.741619	-21	-5.8
98.755678	46.556979	-20	-4
93.448751	46.373792	-19	-2.2
88.183422	46.192041	-18	-0.4
82.959204	46.011709	-17	1.4
77.775617	45.832779	-16	3.2
72.632191	45.655236	-15	5
67.528458	45.479063	-14	6.8
62.463963	45.304244	-13	8.6
57.438254	45.130765	-12	10.4
52.450887	44.958608	-11	12.2
47.501425	44.787761	-10	14
42.589438	44.618206	-9	15.8
37.714501	44.449931	-8	17.6

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32.876198	44.28292	-7	19.4
28.074116	44.11716	-6	21.2
23.30785	43.952635	-5	23
18.577002	43.789334	-4	24.8
13.881177	43.627241	-3	26.6
9.219989	43.466344	-2	28.4
4.593055	43.306629	-1	30.2
0	43.148084	0	32
-4.559548	42.990696	1	33.8
-9.085953	42.834451	2	35.6
-13.579576	42.679338	3	37.4
-18.040772	42.525344	4	39.2
-22.46989	42.372458	5	41
-26.867276	42.220667	6	42.8
-31.233268	42.06996	7	44.6
-35.568202	41.920324	8	46.4
-39.872408	41.77175	9	48.2
-44.146212	41.624225	10	50
-48.389935	41.477738	11	51.8
-52.603893	41.332278	12	53.6
-56.788398	41.187836	13	55.4
-60.943758	41.044399	14	57.2
-65.070276	40.901958	15	59
-69.168252	40.760502	16	60.8
-73.23798	40.620021	17	62.6
-77.279753	40.480506	18	64.4
-81.293856	40.341945	19	66.2
-85.280573	40.20433	20	68
-89.240184	40.06765	21	69.8
-93.172963	39.931896	22	71.6
-97.079183	39.79706	23	73.4
-100.959112	39.66313	24	75.2
-104.813014	39.5301	25	77
-108.64115	39.397958	26	78.8
-112.443778	39.266697	27	80.6
-116.221152	39.136308	28	82.4
-119.973523	39.006782	29	84.2
-123.701138	38.878111	30	86

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-127.404241	38.750285	31	87.8
-131.083074	38.623297	32	89.6
-134.737874	38.497139	33	91.4
-138.368875	38.371803	34	93.2
-141.97631	38.24728	35	95
	38.123562	36	96.8
	38.000642	37	98.6
	37.878513	38	100.4
	37.757165	39	102.2
	37.636593	40	104











































































































































































































