

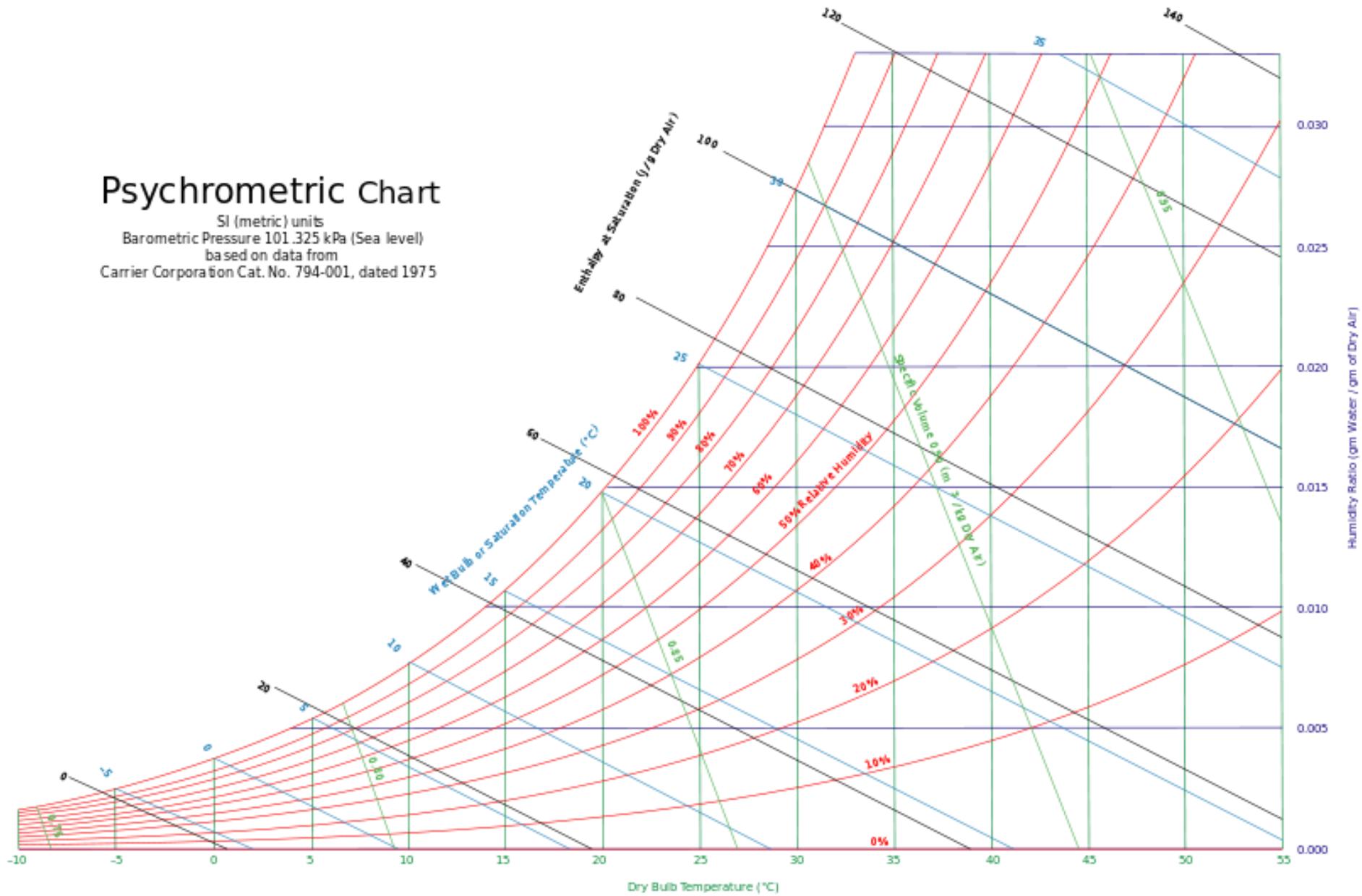
Hygrometer
or
Dry and Wet Bulb Thermometer

- The **wet-bulb temperature** is the temperature a parcel of air would have if it were cooled at constant pressure (adiabatically) to saturation (100% relative humidity) by the evaporation of water into it, with the latent heat being supplied by the parcel.
- An [actual wet-bulb thermometer](#) indicates a temperature close to the true (thermodynamic) wet-bulb temperature.
- The wet-bulb temperature is the lowest temperature that can be reached under current ambient conditions by the evaporation of water only;
- it is the temperature felt when the skin is wet and exposed to moving air.
- Wet-bulb temperature is largely determined by both actual air temperature (dry-bulb temperature) and humidity, the amount of moisture in the air.

- The thermodynamic wet-bulb temperature is the minimum temperature which may be achieved by purely evaporative cooling of a water-wetted (or even ice-covered), ventilated surface.
- For a given parcel air at a known pressure and dry-bulb temperature, the thermodynamic **wet-bulb temperature** corresponds to unique values of **relative humidity**, **dew point temperature**, and other properties. The relationships between these values are illustrated in a **psychrometric chart**.
- For "**dry**" air, air that is less than saturated (i.e., air with less than 100 percent relative humidity), the **wet-bulb temperature is lower than the dry-bulb temperature due to evaporative cooling**.
- The **greater the difference** between the wet and dry bulb temperatures, the **drier the air** and **lower the relative humidity**.
- The dew point temperature is the **temperature at which the ambient air must cool to reach 100% relative humidity** where condensate and rain form; and conversely, the wet-bulb temperature rises to converge on the dry bulb temperature.

Psychrometric Chart

SI (metric) units
Barometric Pressure 101.325 kPa (Sea level)
based on data from
Carrier Corporation Cat. No. 794-001, dated 1975



Procedure and Observation

A simple way to get a value for the relative humidity is to use a wet-and-dry bulb hygrometer (psychrometer).

- First you need a thermometer (two would be better) shaped such that you can wrap a small piece of tissue or cloth around the bulb.
- First measure the air temperature.
- Next wrap a small piece of tissue around the bulb and wet it.
- Wait about ten minutes until the temperature stabilizes - it will be lower due to evaporation.
- Subtract the wet temperature from the dry temperature and look up the humidity in the **hygrometric chart**.

A more permanent setup would use two thermometers and a small water reservoir. The thermometers would be fixed on a card. One thermometer would have a piece of cloth wrapped on the bulb with the end dipping into a small reservoir of water.

Relative Humidity from Wet and Dry Bulb Thermometer (Fahrenheit Scale)

Relative Humidity from Wet-and-Dry Bulb Readings (Values below are in per cent.)																					
Fahrenheit Degrees difference between dry-bulb and wet-bulb readings																					
		04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	
	38	66	58	50	42	33	25	17	10	02											
	40	68	60	52	45	37	29	22	15	07											
	42	69	62	55	47	40	33	26	19	12	05										
	44	71	63	56	49	43	36	30	23	16	10	04									
Dry-	46	72	65	58	52	45	39	32	26	20	14	08	02								
bulb	48	73	66	60	54	47	41	35	29	23	18	12	07	01							
reading	50	74	67	61	55	49	43	38	32	27	21	16	10	05							
in De-	52	75	69	63	57	51	46	40	35	29	24	19	14	09	04						
grees	54	76	70	64	59	53	48	42	37	32	27	22	17	12	08	03					
Fahren-	56	76	71	65	60	55	50	44	39	34	30	25	20	16	11	07	02				
heit	58	77	72	66	61	56	51	46	41	37	32	27	23	18	14	10	06				
	60	78	73	68	63	58	53	48	43	39	34	30	26	21	17	13	09				
	62	79	74	69	64	59	54	50	45	41	36	32	28	24	20	16	12	08	04	01	
	64	79	74	70	65	60	56	51	47	43	38	34	30	26	22	18	15	11	07	04	
	66	80	75	71	66	61	57	53	48	44	40	36	32	29	25	21	17	14	10	07	
	68	80	76	71	67	62	58	54	50	46	42	38	34	31	27	23	20	16	13	10	
	70	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	15	12	
	72	82	77	73	69	65	61	57	53	49	45	42	38	34	31	28	24	21	18	15	
	74	82	78	74	69	65	61	58	54	50	47	43	39	36	33	29	26	23	20	17	
	76	82	78	74	70	66	62	59	55	51	48	44	41	38	34	31	28	25	22	19	
	78	83	79	75	71	67	63	60	56	53	49	46	43	39	36	33	30	27	24	21	
	80	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	26	23	
	82	84	80	76	72	69	65	61	58	55	51	48	45	42	39	36	33	30	28	25	
	84	84	80	76	73	69	66	62	59	56	52	49	46	43	40	37	35	32	29	26	
	86	84	81	77	73	70	66	63	60	57	53	50	47	44	42	39	36	33	31	28	
	88	85	81	77	74	70	67	64	61	57	54	51	48	46	43	40	37	35	32	30	
	90	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	34	31	

Relative Humidity from Wet and Dry Bulb Thermometer (Centigrade Scale)

This table gives the approximate relative humidity directly from the reading of the air temperature (dry bulb) (t °C) and the wet bulb (T °C). It is computed for a pressure of 74.27 cm Hg. Errors resulting from the use of this table for air temperatures above 10°C and between 77.5 and 71 cm Hg will usually be within the errors of observation.

Condensed from Bulletin of the U.S. Weather Bureau No. 1071

$t-T$

t	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0										
	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	16.0	17.0	18.0	19.0				
2	68	65	62	59	55	52	49	46	43	40	37	29	22	14	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
3	70	67	64	61	58	55	52	49	46	43	40	33	26	19	12	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
4	71	68	65	62	60	57	54	51	48	46	43	36	29	22	16	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	72	69	67	64	61	58	56	53	51	48	45	39	33	26	20	13	7	..	..	..	..	..	..	..	..	..	..	..	..	..
6	73	70	68	65	63	60	58	55	53	50	48	41	35	29	24	17	11	5	..	..	..	..	..	..	..	..	..	..	..	..
7	74	72	69	67	64	62	59	57	54	52	50	44	38	32	26	21	15	10	..	..	..	..	..	..	..	..	..	..	..	..
8	75	73	70	68	65	63	61	58	56	54	51	46	40	35	29	24	19	14	8	..	..	..	..	..	..	..	..	..	..	..
9	76	74	71	69	67	64	62	60	58	55	53	48	42	37	32	27	22	17	12	7	..	..	..	..	..	..	..	..	..	..
10	77	74	72	70	68	66	63	61	59	57	55	50	44	39	34	29	24	20	15	10	6	..	..	..	..	..	..	..	..	..
11	78	75	73	71	69	67	65	62	60	58	56	51	46	41	36	32	27	22	18	13	9	5	..	..	..	..	..	..	..	..
12	78	76	74	72	70	68	66	64	62	60	58	53	48	43	39	34	29	25	21	16	12	8	..	..	..	..	..	..	..	..
13	79	77	75	73	71	69	67	65	63	61	59	54	50	45	41	36	32	28	23	19	15	11	7	..	..	..	..	..	..	..
14	79	78	76	74	72	70	68	66	64	62	60	56	51	47	42	38	34	30	26	22	18	14	10	6	..	..	..	..	..	..
15	80	78	76	74	73	71	69	67	65	63	61	57	53	48	44	40	36	32	27	24	20	16	13	9	6	..	..	..	..	..
16	81	76	71	67	63	58	54	50	46	42	38	34	30	26	23	19	15	12	8	5	..	..	..	..	..	..	..	..	..	..
17	81	76	72	68	64	60	55	51	47	43	40	36	32	28	25	21	18	14	11	8	..	..	..	..	..	..	..	..	..	..
18	82	77	73	69	65	61	57	53	49	45	41	38	34	30	27	23	20	17	14	10	7	..	..	..	..	..	..	..	..	..
19	82	78	74	70	65	62	58	54	50	46	43	39	36	32	29	26	22	19	16	13	10	7	..	..	..	..	..	..	..	..
20	83	78	74	70	66	63	59	55	51	48	44	41	37	34	31	28	24	21	18	15	12	9	6	..	..	..	..	..	..	..
21	83	79	75	71	67	64	60	56	53	49	46	42	39	36	32	29	26	23	20	17	14	12	9	6	..	..	..	..	..	..
22	83	80	76	72	68	64	61	57	54	50	47	44	40	37	34	31	28	25	22	19	17	14	11	8	6	..	..	..	..	..
23	84	80	76	72	69	65	62	58	55	52	48	45	42	39	36	33	30	27	24	21	19	16	13	11	8	6	..	..	..	..	
24	84	80	77	73	69	66	62	59	56	53	49	46	43	40	37	34	31	29	26	23	20	18	15	13	10	8	5	..	..	..		
25	84	81	77	74	70	67	63	60	57	54	50	47	44	41	39	36	33	30	28	25	22	20	17	15	12	10	8	..	..	..		
26	85	81	78	74	71	67	64	61	58	54	51	49	46	43	40	37	34	32	29	26	24	21	19	17	14	12	10	5	..	..			
27	85	82	78	75	71	68	65	62	58	56	52	50	47	44	41	38	36	33	31	28	26	23	21	18	16	14	12	7	..	..			
28	85	82	78	75	72	69	65	62	59	56	53	51	48	45	42	40	37	34	32	29	27	25	22	20	18	16	13	9	5				
29	86	82	79	76	72	69	66	63	60	57	54	52	49	46	43	41	38	36	33	31	28	26	24	22	19	17	15	11	7				
30	86	83	79	76	73	70	67	64	61	58	55	52	50	47	44	42	39	37	35	32	30	28	25	23	21	19	17	13	9	5	..				
31	86	83	80	77	73	70	67	64	61	59	56	53	51	48	45	43	40	38	36	33	31	29	27	25	22	20	18	14	11	7	..				
32	86	83	80	77	74	71	68	65	62	60	57	54	51	49	46	44	41	39	37	35	32	30	28	26	24	22	20	16	12	9	5				