3. What is a psychrometer

The **psychrometer** (from the Greek "psykhrós" = cold + "métron" = measure) is an instrument for measuring the humidity, or the amount of water vapor in the air.

It is made of two identical thermometers, one of which -- surrounded by a moistened wick, gauze or muslin sleeve -- is always kept wet, and consequently is cooler than the air, due to water evaporation. The drier the air around is, the faster the water evaporates and the greater the temperature difference between the two thermometers.

Thist difference is used to determine -- through a "psychrometric table" (Table 1 next) -- the humidity of the air. For example, the instrument shown in Fig. 1 indicates a dry bulb temperature of 22.5ºC and a wet bulb temperature of 20.0ºC, i.e., a difference of 2.5ºC. The psychrometric table indicates a corresponding relative humidity of 80% (see the highlighted cells in Table 1).

Table 1
PSYCHROMETRIC TABLE
Relative Humidity (%) - sea level

Dry Bulb	Dry bulb minus Wet bulb (ºC)									
ºC	1	2	3	4	5	6	7	8	9	10
10	88	77	66	55	44	34	24	15	6	
11	89	78	67	56	46	36	27	18	9	
12	89	78	68	58	48	39	29	21	12	
13	89	79	69	59	50	41	32	22	15	7
14	90	79	70	60	51	42	34	25	18	10
15	90	81	71	61	53	44	36	27	20	13
16	90	81	71	63	54	46	38	30	23	15
17	90	81	72	64	55	47	40	32	25	18
18	91	82	73	65	57	49	41	34	27	20
19	91	82	74	65	58	50	43	36	29	22
20	91	83	74	67	59	53	46	39	32	26
21	91	83	75	67	60	53	46	39	32	26
22	91	83	76	68	61	54	47	40	34	28
23	92	84	76	69	62	55	48	42	36	30
24	92	84	77	69	62	56	49	43	37	31
25	92	84	77	70	63	57	50	44	39	33

The psychrometer was invented in 1825 by the German meteorologist Ernst Ferdinand August. In 1892, another German meteorologist, Richard Assman, introduced the "Aspirated Psychrometer", an enhancement over the August model. In the Assman psychrometer, the air is forced to pass through the wet bulb, thus increasing the evaporation rate and making the measurement more precise (Fig. 2). Another variant is the "Sling Psychrometer", in which ventilation is achieved by whirling it in the air before taking a reading (Fig. 3).

The August psychrometer has the following characteristics:

- *Practicity*: easy to use, fast results (in a few minutes).
- *Simplicity*: only two thermometers and a wet gauze.
- *Durability*: practically unlimited useful life.
- *Cost*: starting from US$ 25 (or less, if home made).
- *Maintenance*: no moving parts, no electricity.
- *Accuracy*: around 5% when ventilated.
- *Long term stability*: practically does not change with time.
- *Reference*: may be used to check the accuracy of other humidity meters.

An alternative to the psychrometer is the Capacitive Hygrometer, a solid state device which indicates digitally the humidity, by measuring the dielectric constant of the moist air, by means of an electronic capacitor (Fig. 4). This instrument is small and more accurate then the psychrometer and is commercially available, starting at prices of aproximately US$ 30. It does not use any wet materials, but needs electricity to work. Its long term stability is fair, needing recalibration from time to time, and it does not work well in high relative humidity environments -- when condensation may occur.

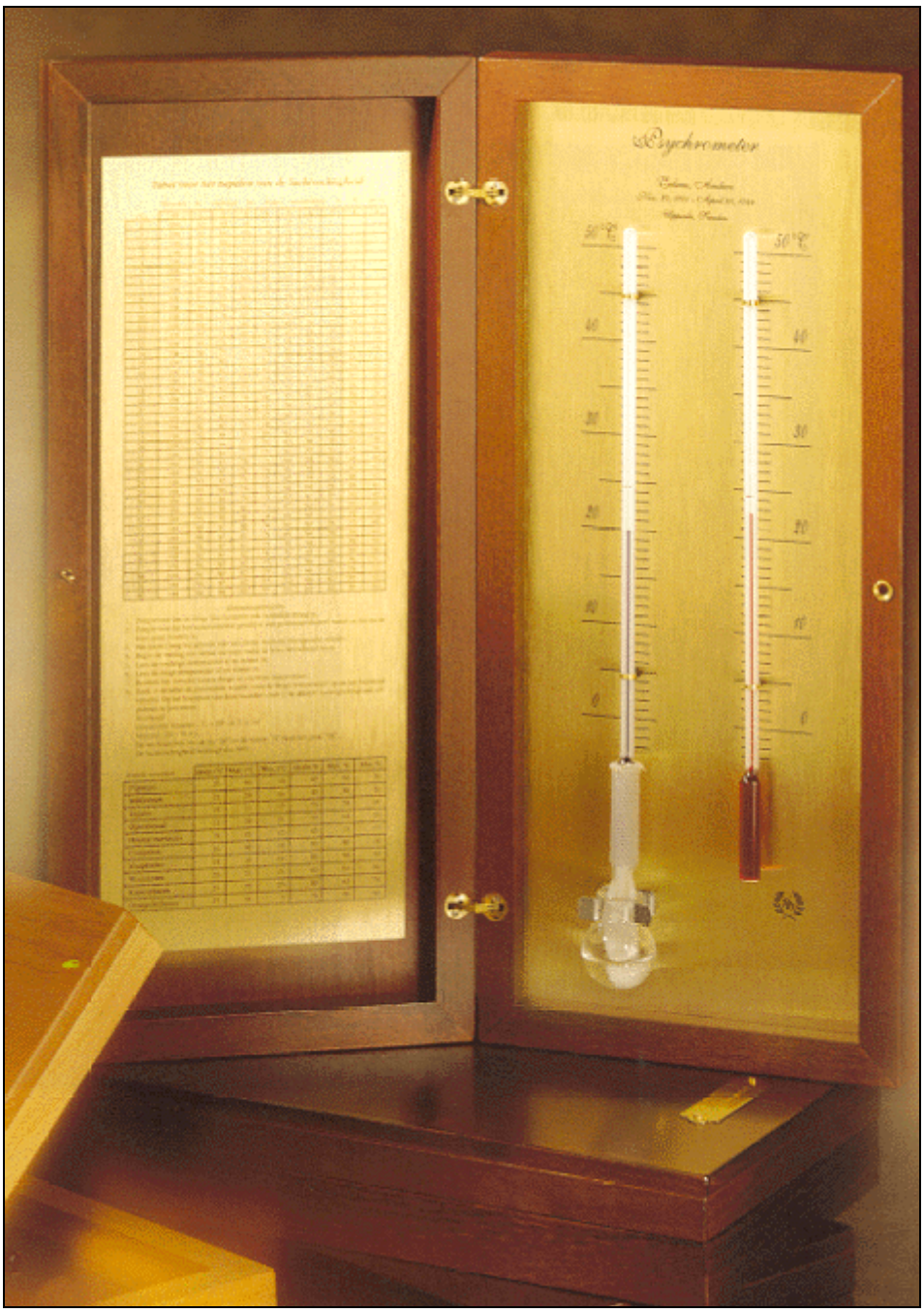

Figure 1: August Psychrometer

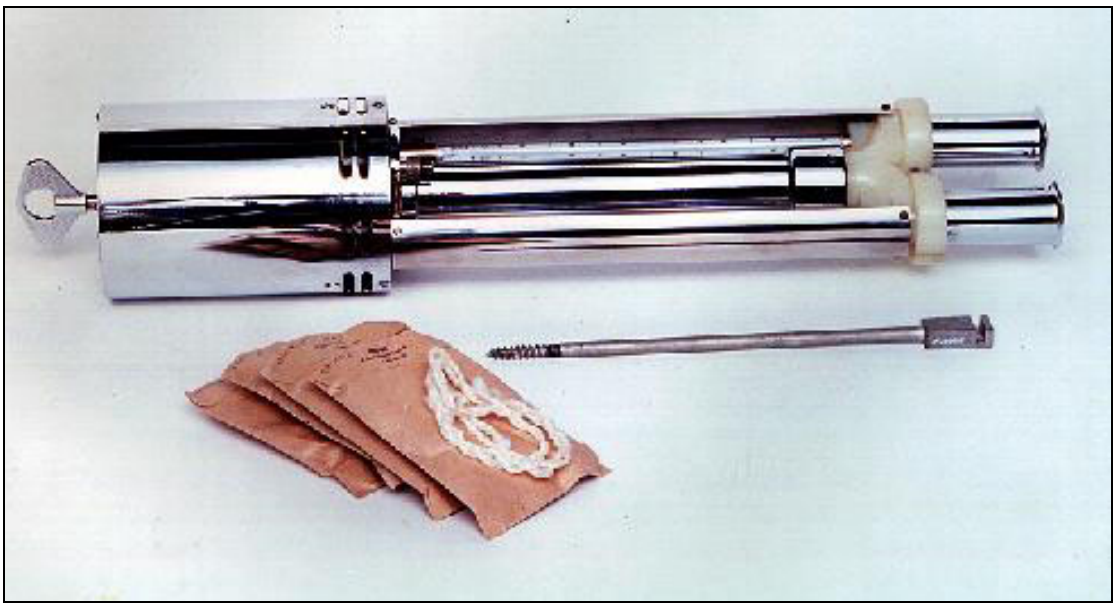

Figure 2: Assman Psychrometer (aspirated)

Figure 3: Sling Psychrometer (US Weather Bureau type)

Figure 4: Electronic Humidity Meter