*weekly_submission_**09***

Giulia Borlenghi (matr. 926137)

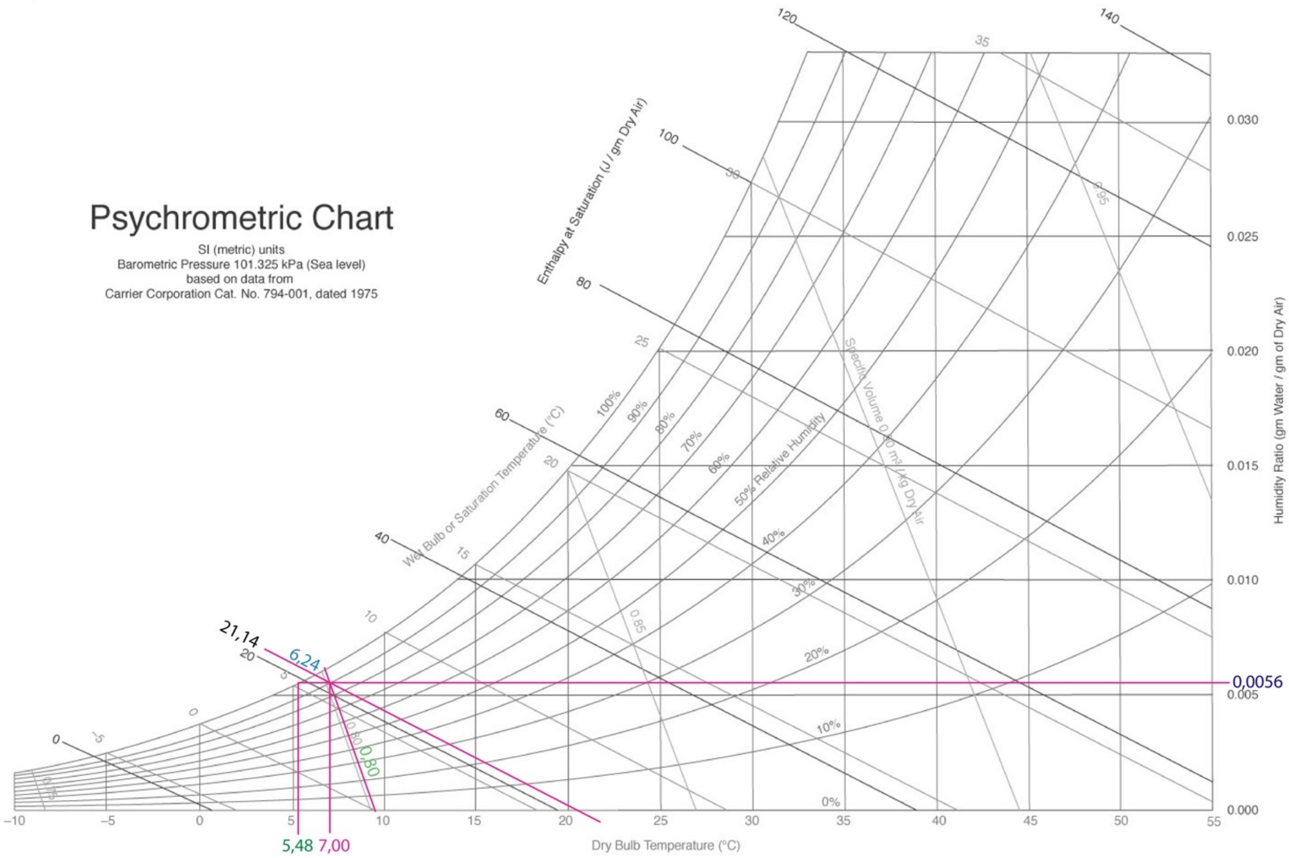
> Use a weather forecast website, and utilize the psychrometric chart and the formula we went through in the class to determine the absolute humidity, the wet-bulb temperature and the mass of water vapor in the air in ClassRoom A (Aula A) of Piacenza campus in the moment that you are solving this exercise (provide the inputs that you utilized).

Il tempo oggi in Piacenza
Domenica, 01 Dicembre 2019

	19:00
	pioggia
Temperatura effettiva	7°C
Temperatura percepita	7°C
Precipitazioni	3 mm
Umidità	90 %
Pressione atmosferica	1018 hPa
Intensità del vento	3 km/h
Direzione del vento	SW
Probabilità di nebbia	0 %
Punto di rugiada	6°C
Nuvole	100 %
Nuvole basse	99 %
Nuvole medie	100 %
Nuvole alte	100 %

Piacenza
Sunday, December 1, 2019.
7:00 PM.
Air Total Pressure 1018 hPa = 101,8 KPa

Dry-bulb Temperature	7,00 °C
Relative Humidity (ϕ)	90%
Humidity Ratio (ω) *(Absolute Humidity)*	**0,0056 gm water / gm Dry Air**
Enthalpy	21,14 J / gm Dry Air
Welt-bulb Temperature *(Saturation Temperature)*	**6,24 °C**
Dew-point Temperature	5,48 °C
Specific Volume	0,80 m^3 Dry Air



Assuming that the temperature and the pressure inside ClassRoom A, during Sunday, December 1, 2019 are equal to the values outside, and that the dimensions of the ClassRoom are about $20m$ x $6m$ x $6m$, so the volume is $720m^2$. To calculate the mass of water vapor in the air:

Using the formula:

$$\omega = \frac{0{,}622 \cdot P_v}{(P - P_v)}$$

We can find the value of P_V

$$P_v = \frac{P \cdot \omega}{0{,}622 + \omega} = \frac{101{,}8 \cdot 0{,}0056}{0{,}622 + 0{,}0056} = 0{,}91\ kPa$$

Then, to calculate the mass of the water vapor, we can use the formula:

$$m_v = \frac{P_v \cdot V}{R_v \cdot T} = \frac{0{,}91 \cdot 720}{0{,}4615 \cdot (273 + 7)} = 5{,}07\ Kg$$

> A building with a height of 2.5 m and an *GOOD* construction quality, is located in Brindisi, considering two occupants and one bed room and a conditioned floor area of $200\ m^2$ and wall area of $144\ m$, calculate the internal gains, infiltration, and ventilation loads.

BRINDISI, Italy WMO#: **163200**

Lat: **40.65N** Long: **17.95E** Elev: **10** StdP: **101.2** Time Zone: **1.00 (EUW)** Period: **86-10** WBAN: **99999**

Annual Heating and Humidification Design Conditions

	Coldest Month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB		
				99.6%			99%			0.4%		1%				
		99.6%	99%	DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	
(1)	2	2.9	4.1	-5.1	2.5	7.2	-3.0	3.0	7.4	13.4	10.2	12.4	10.6	3.4	250	(1)

Annual Cooling, Dehumidification, and Enthalpy Design Conditions

	Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB		
			0.4%		1%		2%		0.4%		1%		2%				
			DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(2)	8	7.1	32.8	23.6	31.1	24.3	29.9	24.3	27.2	29.7	26.3	29.0	25.6	28.3	4.2	180	(2)

INTERNAL GAINS

$$\dot{Q}_{IG\_sensible} = 136 + 2{,}2 \cdot A_{cf} + 22 \cdot A_{no} = 136 + 2{,}2 \cdot 200 + 22 \cdot 2 = 620\ W$$

$$\dot{Q}_{IG\_latent} = 20 + 0{,}22 \cdot A_{cf} + 12 \cdot A_{no} = 20 + 0{,}22 \cdot 200 + 12 \cdot 2 = 88\ W$$

INFILTRATIONS

good quality → $A_{ul} = 1{,}4\ {cm^2}/{m^2}$
exposed surface → $A_{ex} = A_{wall} + A_{roof} = 144 + 200 = 344\ m^2$

$$A_l = A_{ul} \cdot A_{ex} = 1{,}4 \cdot 344 = 481{,}6\ cm^2$$

Heating DB (99%) = 4,1 °C
Cooling DB (1%) = 31,1 °C

$\text{IDF}_{\text{heating}} = 0{,}065 \ {}^{L}/_{S\ cm^2}$
$\text{IDF}_{\text{cooling}} = \ 0{,}032 \ {}^{L}/_{S\ cm^2}$

$\dot{V}_{infiltration\_heating} = A_l \cdot IDF_{heating} = 481{,}6 \cdot 0{,}065 = 31{,}30 \, {}^{L}/_{S}$
$\dot{V}_{infiltration\_cooling} = A_l \cdot IDF_{cooling} = 481{,}6 \cdot 0{,}032 = 15{,}41 \, {}^{L}/_{S}$

VENTILATION

$\dot{V}_{ventilation} = 0{,}05 \cdot A_{cf} + 3{,}5 \cdot (N_{br} + 1) = 0{,}05 \cdot 200 + 3{,}5(1 + 1) = 17 \, {}^{L}/_{S}$

$\dot{V}_{infiltration\_ventilation\_cooling} = 15{,}41 + 17 = 32{,}41 \, {}^{L}/_{S}$
$\dot{V}_{infiltration\_ventilation\_heating} = 31{,}30 + 17 = 48{,}30 \, {}^{L}/_{S}$

$\Delta T_{heating} = 20 - 4{,}1 = 15{,}9 \,°C$
$\Delta T_{cooling} = 31{,}1 - 24 = 7{,}1 \,°C$

$$\dot{Q}_{infiltration\_ventilation\_cooling\_sensible} = \dot{C}_{sensible} \cdot \dot{V}_{infiltration\_ventilation\_cooling} \cdot \Delta T_{cooling} = 1{,}23 \cdot 32{,}41 \cdot 7{,}1 = 283{,}04 \, W$$

$$\dot{Q}_{infiltration\_ventilation\_heating\_sensible} = \dot{C}_{sensible} \cdot \dot{V}_{infiltration\_ventilation\_heating} \cdot \Delta T_{heating} = 1{,}23 \cdot 48{,}30 \cdot 15{,}9 = 944{,}60 \, W$$

Assuming a Relative Humidity of 50% and $T_{out} = 31{,}1°C$ and $T_{in} = 24{,}00°C$ and using the psychrometric chart, it's possible to determinate the value of ω_{out} and ω_{in} and find the $\Delta\omega_{cooling}$:

$\Delta\omega_{cooling} = \omega_{out} - \omega_{in} = 0{,}0143 - 0{,}0093 = 0{,}005$

$$\dot{Q}_{infiltration\_ventilation\_cooling\_latent} = \dot{C}_{latent} \cdot \dot{V}_{infiltration\_ventilation\_cooling} \cdot \Delta\omega_{cooling} = 3010 \cdot 32{,}41 \cdot 0{,}005 = 487{,}77 \, W$$