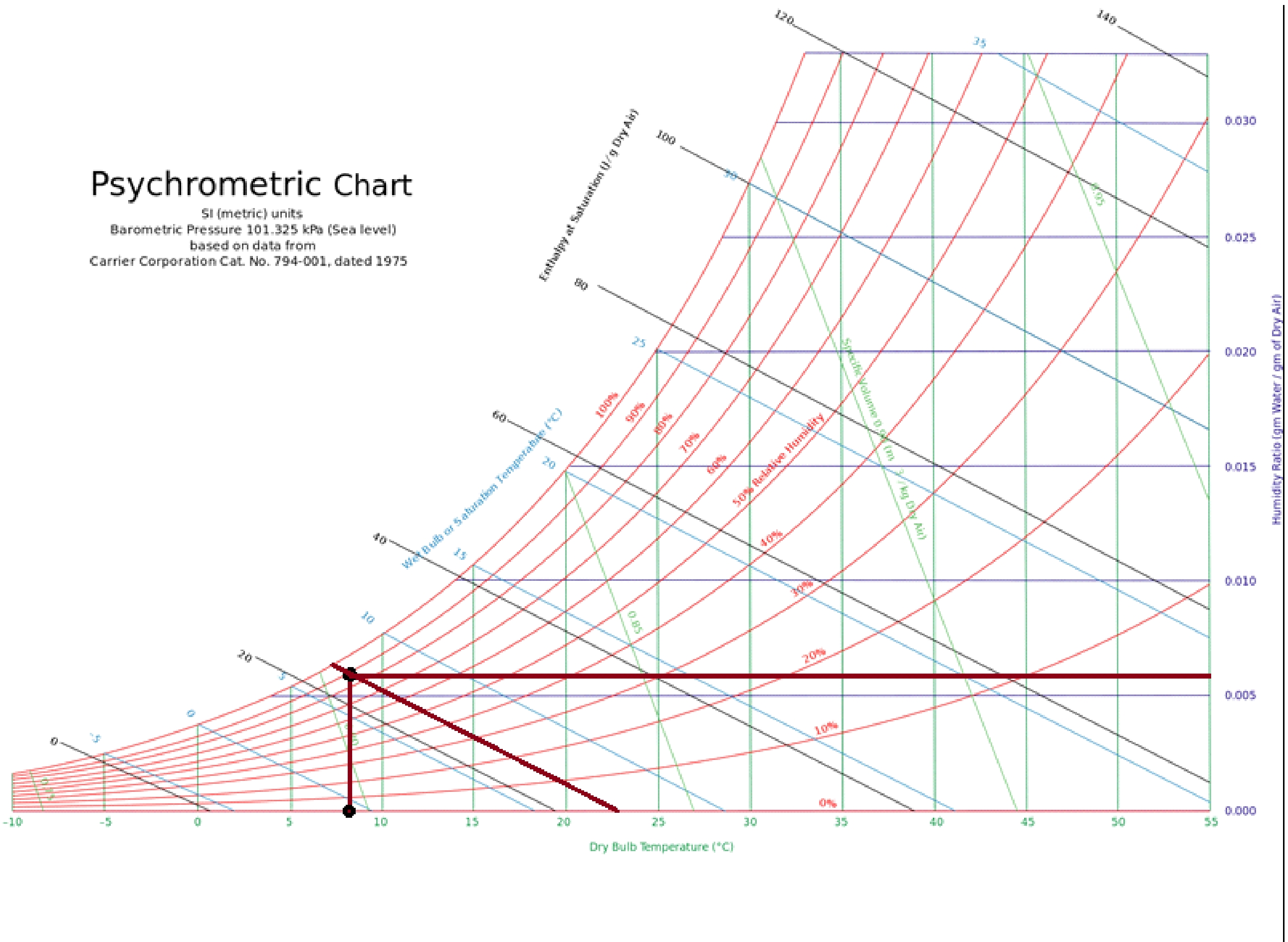
Task 1 Use a weather forecast website, and utilize the psychrometric chart and the formula we went through in the class to determine the absoloute humidity, the wet-bulb temperature and the mass of water vapour in the air in ClassRoom A (Aula A) of Piacenza campus in the moment that you are solving this exercise (provide the inputs that you utilized)

Lunedì, 09 Dicembre 2019

	05:00	07:00	10:00	14:00	18:00	19:00	21:00
	Cloud	Cloud	Cloud	PartlyCloud	Sun	Sun	Sun
Temperatura effettiva	7°C	7°C	8°C	10°C	7°C	6°C	6°C
Temperatura percepita	7°C	6°C	8°C	10°C	6°C	5°C	4°C
Precipitazioni	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Umidità	95 %	97 %	91 %	83 %	93 %	93 %	85 %
Pressione atmosferica	1010 hPa	1010 hPa	1009 hPa	1007 hPa	1007 hPa	1008 hPa	1008 hPa
Intensità del vento	3 km/h	7 km/h	3 km/h	6 km/h	6 km/h	6 km/h	10 km/h
Direzione del vento	N	O	O	N	NO	SW	O
Probabilità di nebbia	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Punto di rugiada	6°C	6°C	7°C	7°C	6°C	5°C	3°C
Nuvole	100 %	100 %	95 %	56 %	9 %	3 %	0 %
Nuvole basse	78 %	91 %	95 %	56 %	4 %	0 %	0 %
Nuvole medie	63 %	6 %	5 %	0 %	5 %	3 %	0 %
Nuvole alte	99 %	100 %	0 %	0 %	0 %	0 %	0 %

Current time is 10.00 so the datas are:
Humidity:91% $\phi = \mathrm{Pa}$
Presure: 1009 hPa P$= 100.9\ \mathrm{kPa}$
Temperature: 8 ∘ c $\mathrm{T} = 281.15$K



From the psychrometric chart we can read that:
absolute humidity is $\omega = 0.0055$
The web-bulb temperature is $T_{wb} = 7^0c$

$$P_a = P - P_v$$

$$\omega = 0.0055 = 0.622\frac{P_v}{P_a}$$

$$\frac{0.622P_v}{101.9 - P_v} = 0.0055$$

$$P_v = 0.893kPa$$

$$Wather\ vapour \square P_v = 0.893$$

Volume of aula A $m_v = \frac{0.893\text{V}}{0.4615*230} \approx 8.41\text{x}10^{-3}V$

Maximum water vapor $m_g = \frac{m_v}{90\%} \approx 9.34\text{x}10^{-3}V$

Task 2 Utilize the same methodology we went through in the class and determine the sensible and latent load corresponding to internal gains, the ventilation, and the infiltration in a house with a *good* construction quality and with the same geometry as that of the example which is located in Brindisi, Italy

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**

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Annual Heating and Humidification Design Conditions

	Coldest Month	Heating DB		Humidification DP/MCDB and HR 99.6%			Humidification DP/MCDB and HR 99%			Coldest month WS/MCDB 0.4%		Coldest month WS/MCDB 1%		MCWS/PCWD to 99.6% DB		
		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 0.4%		Cooling DB/MCWB 1%		Cooling DB/MCWB 2%		Evaporation WB/MCDB 0.4%		Evaporation WB/MCDB 1%		Evaporation WB/MCDB 2%		MCWS/PCWD to 0.4% DB		
			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)

	Dehumidification DP/MCDB and HR 0.4%			Dehumidification DP/MCDB and HR 1%			Dehumidification DP/MCDB and HR 2%			Enthalpy/MCDB 0.4%		Enthalpy/MCDB 1%		Enthalpy/MCDB 2%		Hours 8 to 4 & 12.8/20.6	
	DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB		
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(3)	26.3	21.8	29.2	25.4	20.7	28.5	24.7	19.7	27.9	86.0	30.1	82.2	29.1	78.5	28.3	1236	(3)

Extreme Annual Design Conditions

	Extreme Annual WS			Extreme Max WB	Extreme Annual DB Mean		Extreme Annual DB Standard deviation		n-Year Return Period Values of Extreme DB n=5 years		n=10 years		n=20 years		n=50 years		
	1%	2.5%	5%		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	
(4)	11.3	9.9	8.7	31.4	0.4	37.3	1.4	3.0	-0.6	39.4	-1.4	41.1	-2.2	42.8	-3.2	44.9	(4)

internal gains

Calculate the sensible cooling load from internal gains,

$$q_{ig,s} = 136 + 2.2A_{cf} + 22N_{oc} = 136 + 2.2 * 200 + 22 * 2 = 620 \text{ W}$$

Calculate the latent cooling load from internal gains,

$$q_{ig,l} = 20 + 0.22A_{cf} + 12N_{oc} = 20 + 0.22 * 200 + 12 * 2 = 88 \text{ W}$$

Infiltration

for a house with a good construction quality, unit leakage area $A_{ul} = 1.4 cm^2/m^2$

and the exposed surface $A_{es} = A_{wall} + A_{roof} = 200 + 144 = 344\ m^2$

cooling temperature $T_{cooling}$ *=24 °C, and heating temperature* $T_{heating}$ *=20 °C in Brindisi,*

$\Delta T_{cooling} = 31.1\ °C - 24\ °C = 7.1\ °C = 7.1\ K$

$\Delta T_{heating} = 20\ °C - (-4.1\ °C) = 24.1\ °C = 24.1\ K$

DR = 7.1 °C = 7.1 K

Given that $IDF_{heating} = 0.073 \frac{L}{s*Cm^2}$

$IDF_{cooling} = 0.033 \frac{L}{s*Cm^2}$

infiltration airflow rate

$Q_{i,heating} = A_L * IDF_{heating} = 481.6 * 0.073 \approx 35.157 \frac{L}{s}$

$Q_{i,cooling} = A_L * IDF_{cooling} = 481.6 * 0.033 \approx 15.893 \frac{L}{s}$

The required miminum whole-building vetilation rate is

$Q_v = 0.05A_{cf} + 3.5(N_{br} + 1) = 0.05 * 200 + 3.5 * (1 + 1) = 17 \frac{L}{s}$

$Q_{i\text{-}v,heating} = Q_{i,heating} + Q_v \approx 35.157 + 17 = 52.157 \frac{L}{s}$

$Q_{i\text{-}v,cooling} = Q_{i,cooling} + Q_v \approx 15.893 + 17 = 32.893 \frac{L}{s}$

Given that $C_{sensible} = 1.23$, $C_{latent} = 3010$, $11w_{Cooling} = 0.0039$

$\dot{q}_{inf\text{-}ventilation_{coolingsensible}} = C_{sensible} Q_{i\text{-}v,cooling} \Delta^{LT}Cooling \approx 1.23 * 32.893 * 7.1 \approx 287.25$ W

$\dot{q}_{inf\text{-}ventilation_{coolinglatent}} = C_{latent} Q_{i\text{-}v,cooling} {}^{Lw}Cooling \approx 3010 * 32893 * 0.0039 \approx 386.13$ W

$\dot{q}_{inf\text{-}ventilation_{heatinggsensible}} = C_{sensible} Q_{i\text{-}v,heating} {}^{LT}heating \approx 1.23 * 52.157 * 24.1 \approx 1546.09$ W