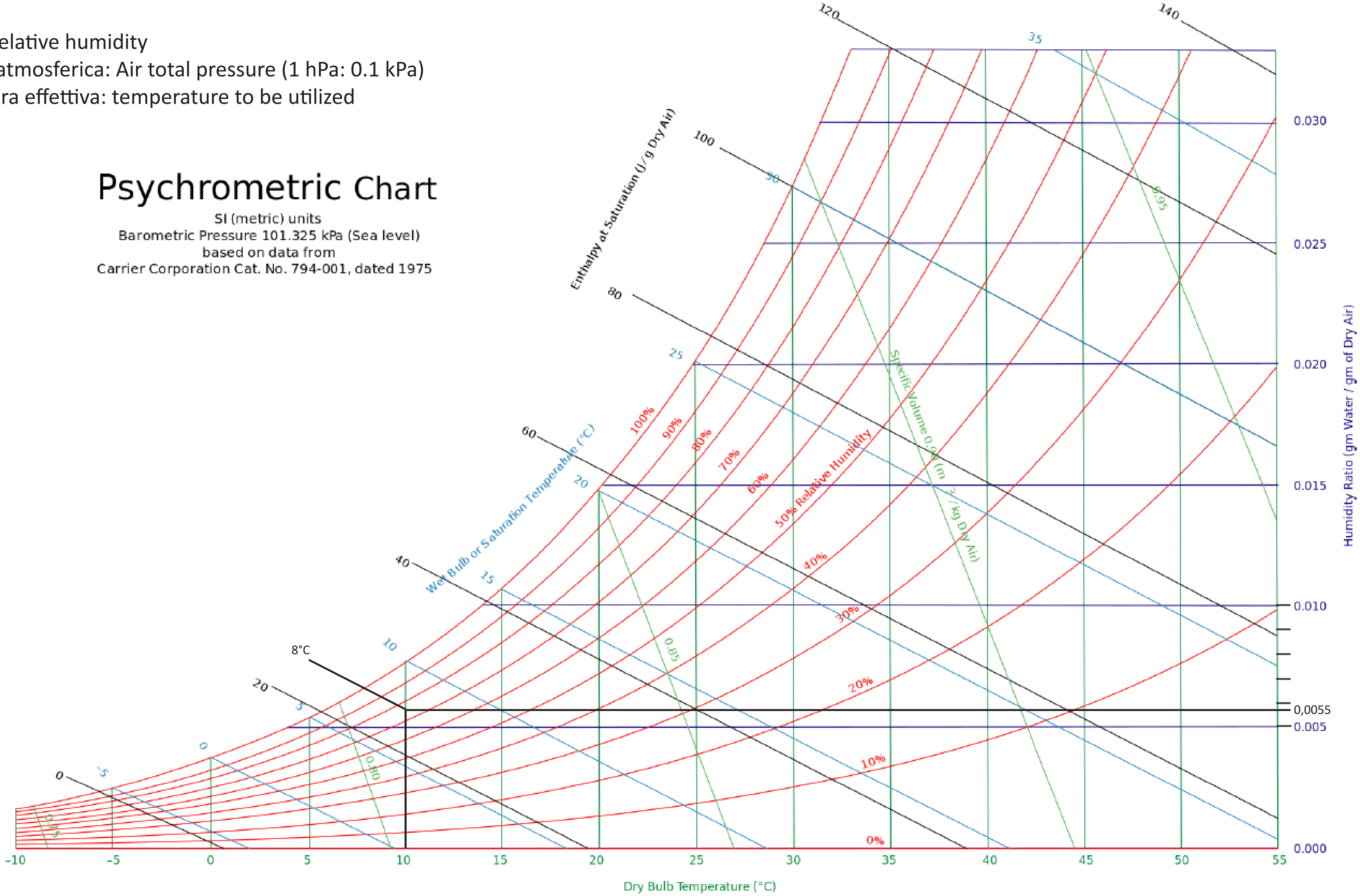
Task 1. Use a weather forecast website, and utilize the psychrometric chart and the formula we went through in the class to determine the absoloute humidity, the wet-bulb temperature and the mass of water vapour in the air in ClassRoom A (Aula A) of Piacenza campus in the moment that you are solving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

Umidità: Relative humidity
Pressione atmosferica: Air total pressure (1 hPa: 0.1 kPa)
Temperatura effettiva: temperature to be utilized



a) Wet-bulb temperature

From the psychrometric chart we can obtain that the Wet-bulb temperature is equal to 8°C.

b) Absolute humidity

Info obtaing from the suggested weather webpage:

$T = 10°C$

$P = 1025\ Hpa = 102{,}5 Kpa$

$\varphi = 65\% = 0{,}65$

$Pv = \varphi \cdot Pg$

$Pv = 0{,}65 \cdot 1{,}227 Kpa$

$Pv = 0{,}79\ Kpa$

$Pa = P - Pv$

$Pa = 102{,}5\ Kpa - 0{,}79 Kpa$

$Pa = 101{,}71 Kpa$

$\omega = 0{,}622\ (Pv/Pa)$

$\omega = 0{,}622\ (0{,}79 Kpa\ /\ 101{,}71 Kpa)$

$\omega = 0{,}622 \cdot 0{,}007$

$\omega = 0{,}0043\ Kg_{vapour}/Kg_{dryair}$

The absolute humidity is equal to 0,0043 Kg_{vapour}/Kg_{dryair}

c) Mass of water

$$Ma = \frac{Pa \cdot (Volume)}{Ra \cdot T}$$

$$Ma = \frac{101{,}71 Kpa \cdot (5m \cdot 15m \cdot 3m)}{0{,}287 \cdot (275 + 10)}$$

$$Ma = \frac{101{,}71 Kpa \cdot 225 m^3}{81{,}795}$$

$$Ma = \frac{22884{,}75}{81{,}795}$$

$Ma = 279{,}78\ Kg$ *The mass of water vapour in the air, on the classroom is equal to 279,78Kg*

Il tempo oggi in Piacenza *Martedì, 03 Dicembre 2019*							
	13:00	14:00	16:00	18:00	20:00	21:00	22:00
	LightCloud	LightCloud	PartlyCloud	LightCloud	Sun	Sun	Sun
Temperatura effettiva	9°C	10°C	8°C	6°C	4°C	2°C	2°C
Temperatura percepita	7°C	10°C	6°C	4°C	2°C	0°C	0°C
Precipitazioni	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Umidità	67 %	65 %	69 %	70 %	75 %	83 %	87 %
Pressione atmosferica	1025 hPa	1025 hPa	1025 hPa	1026 hPa	1027 hPa	1027 hPa	1028 hPa
Intensità del vento	15 km/h	14 km/h	9 km/h	9 km/h	7 km/h	8 km/h	8 km/h
Direzione del vento	E	E	E	E	SE	SE	SE
Probabilità di nebbia	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Punto di rugiada	3°C	3°C	3°C	1°C	-1°C	0°C	-1°C
Nuvole	21 %	13 %	42 %	15 %	2 %	3 %	3 %
Nuvole basse	11 %	7 %	42 %	15 %	2 %	3 %	3 %
Nuvole medie	18 %	12 %	2 %	0 %	1 %	0 %	0 %
Nuvole alte	0 %	0 %	0 %	0 %	0 %	0 %	0 %

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**

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)

	Dehumidification DP/MCDB and HR									Enthalpy/MCDB						Hours 8 to 4 & 12.8/20.6	
	0.4%			1%			2%			0.4%		1%		2%			
	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				n-Year Return Period Values of Extreme DB								
					Mean		Standard deviation		n=5 years		n=10 years		n=20 years		n=50 years		
	1%	2.5%	5%	WB	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)

Infiltration

Average quality -> Aul=2.8 (cm²)/(m²)

Exposed surface = Wall area + roof area

A_{es}=200 + 144= 344 m²

$A_L = A_{es} \times A_{ul}$= 344×2,80= 963,20 cm²

IDFheating= 0,063 L/s.cm²
IDFcooling= 0,0321 L/s.cm²

Vinfiltration$_{\text{heating}}$= 963,20 cm² x 0,063 L/s.cm²= **60,6816 L/s**

Vinfiltration$_{\text{cooling}}$= 963,20 cm² x 0,0321 L/s.cm²= **30,91 L/s**

Table 5 Typical IDF Values, L/(s·cm²)

H, m	Heating Design Temperature, °C					Cooling Design Temperature, °C			
	−40	−30	−20	−10	0	10	30	35	40
2.5	0.10	0.095	0.086	0.077	0.069	0.060	0.031	0.035	0.040
3	0.11	0.10	0.093	0.083	0.072	0.061	0.032	0.038	0.043
4	0.14	0.12	0.11	0.093	0.079	0.065	0.034	0.042	0.049
5	0.16	0.14	0.12	0.10	0.086	0.069	0.036	0.046	0.055
6	0.18	0.16	0.14	0.11	0.093	0.072	0.039	0.050	0.061
7	0.20	0.17	0.15	0.12	0.10	0.075	0.041	0.051	0.068
8	0.22	0.19	0.16	0.14	0.11	0.079	0.043	0.058	0.074

Heating:
10°C ________________ 0,009
4,1°C ________________x=
0,00369

0,00369 + 0,060= 0,06369 (0,063)

Cooling:
5°C________________0,005
1,1°C ________________x= 0,0011

0,0011 + 0,031= 0,0321

Internal gains

Qigsensible= 136 + 2,2 x area + 22 Noc
136 + (2,2 x 200) + (22 x 2)
620W

Qiglatent= 20 + (0,22 x area) + 12 Noc=
20 + (0,22 x 200) + (12 x 2) =
88W

Ventilation

V= 0,05 x area + (3,50 x (Nbr + 1))
V= 0,05 X 200m² + 3,50 (1 + 1)
V= 10 + (3,50 x 2)
V= 10+ 7
V= 17L/s

Vinfiltration-vent.$_{\text{heating}}$= 60,6816 L/s - 17L/s = 43,68 L/s
Vinfiltration-vent.$_{\text{cooling}}$= 30,91 L/s - 17L/s = 13,91 L/s

Franco, Julia Lis
10682257

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