<u>WEEK 9</u>

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<u>Task 1</u>

Use a weather forecast website, and utilize the psychometric 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)
Humidity: Relative humidity, Atmospheric Pressure: Air total pressure (1 hPa: 0.1 kPa), Temperatura effettiva: temperature to be utilized.

	17:00	18:00	19:00	20:00	21:00	22:00	23:00
	Cloud	Cloud	Cloud	Cloud	Drizzle	LightRain	LightRain
Temperatura effettiva	7°C	7°C	6°C	6°C	6°C	6°C	7°C
Temperatura percepita	7°C	7°C	6°C	5°C	6°C	6°C	7°C
Precipitazioni	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Umidità	95 %	95 %	97 %	98 %	96 %	96 %	95 %
Pressione atmosferica	1021 hPa	1021 hPa	1021 hPa	1021 hPa	1021 hPa	1021 hPa	1020 hPa
Intensità del vento	3 km/h	3 km/h	4 km/h	5 km/h	4 km/h	3 km/h	2 km/h
Direzione del vento	NO	O	O	O	O	O	O
Probabilità di nebbia	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Punto di rugiada	6°C	6°C	6°C	5°C	6°C	6°C	6°C
Nuvole	100 %	95 %	98 %	99 %	100 %	100 %	100 %
Nuvole basse	99 %	67 %	73 %	89 %	100 %	100 %	100 %
Nuvole medie	75 %	53 %	19 %	19 %	99 %	99 %	92 %
Nuvole alte	91 %	88 %	89 %	95 %	95 %	95 %	100 %

Chosen time: 19:00

Relative humidity Φ= 97%

Total air pressure = 1021hPa = 102.1kPa Temperature =6°C

Aula A= 10m x 5m x 4m = 200 m3

From the chart with the weather data :
The absolute humidity ω= 0.0175
Wet bulb temp Twb: 22.5

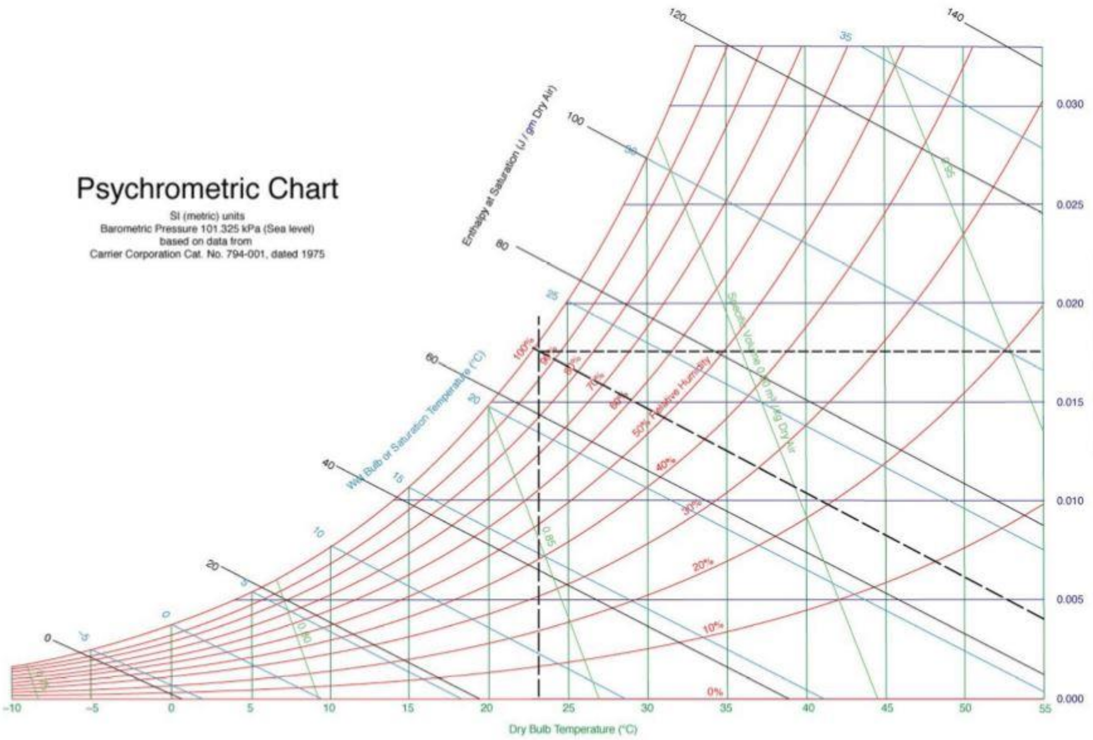
$$w = \frac{0.622\,pv}{Pa} = \frac{0.622\,pv}{p - pv} = 0.0175$$

So $0.0175 = \frac{0.622\,pv}{102.2 - pv}$
So in conclusion $Pv=2.8\,Kpa$

mv=$\frac{pv}{RSpT} = \frac{(2.8)(200)}{0.4615(273+6)} = 4.35$

Φ=$\frac{mv}{mg} = \frac{pv}{pg} = 97\%$

$$mg = \frac{4.35}{0.97} = 4.48\,kg$$



Task2

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

$$Q_{ig_{sensible}} = 136 + 2.2 \times A_{cf} + 22N_{oc}$$
$$Q_{ig_{sensible}} = 136 + 2.2 \times 200 + 22 \times 2$$
$$Q_{ig_{sensible}} = 620\,W$$

$$Q_{ig_{latent}} = 20 + 0.22 \times A_{cf} + 12N_{oc}$$
$$Q_{ig_{latent}} = 20 + 0.22 \times 200 + 12 \times 2$$
$$Q_{ig_{sensible}} = 88\,W$$

$$A_{es} = 200 + 144 = 344\,m^2$$
$$A_L = 344 \times 1.4 = 481.6\,cm^2$$

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)

$$IDF_{heating} = 0.06369 \frac{L}{s \times cm^2}$$

$$IDF_{cooling} = 0.03188 \frac{L}{s \times cm^2}$$

$$V_{infiltration_{heating}} = A_L \times IDF = 481.6\,cm^2 \times 0.06369 \frac{L}{s \times cm^2} = 30.6731 \frac{L}{s}$$

$$V_{infiltration_{cooling}} = A_L \times IDF = 481.6\,cm^2 \times 0.03188 \frac{L}{s \times cm^2} = 15.3534 \frac{L}{s}$$

$$V_{ventilation} = 0.05\,A_{cf} + 3.5(N_{br} + 1) = 0.05 \times 200m^2 + 3.5 \times 2 = 17 \frac{L}{s}$$

$$V_{inf-ventilation_{heating}} = 30.67 \frac{L}{s} + 17 \frac{L}{s} = 47.67 \frac{L}{s}$$

$$V_{inf-ventilation_{cooling}} = 15.35 \frac{L}{s} + 17 \frac{L}{s} = 32.35 \frac{L}{s}$$

$$Qinf - ventilation_{cooling_{sensible}} = C_{sensible} V \Delta T_{cooling} = 1.23 \times 32.35 \frac{L}{s} \times 7.1 = 282.51\,W$$

$$Qinf - ventilation_{cooling_{latent}} = C_{latent} V \Delta\omega_{cooling} = 3010 \times 32.35 \frac{L}{s} \times 0.0039 = 379.75\,W$$

$$Qinf - ventilation_{heating_{sensible}} = C_{sensible} V \Delta T_{heating} = 1.23 \times 47.67 \frac{L}{s} \times 15.9 = 932.28\,W$$

$$Qinf - ventilation_{heating_{latent}} = C_{latent} V \Delta\omega_{heating} = 3010 \times 47.67 \frac{L}{s} \times 0.0065 = 932.66\,W$$