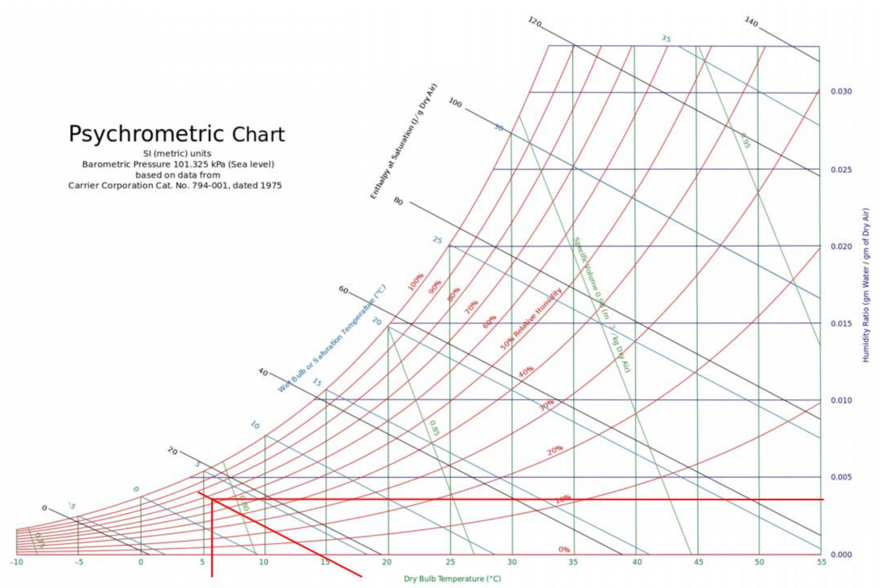
Week 8 --- Kou Yu

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)



From the chart, we can see:

P = 101.7 KPa T = 6 C

$$\omega = \frac{0.622P_V}{P_a} = \frac{0.622P_V}{P - P_V} = 0.0055$$

$T_{wb} = 5.2°C$ $P_v \approx 0.893\ kPa$ $\phi = \frac{m_v}{m_g} = 90\%$

Introduce the pressure of water vapor $P_V = 0.893KPa$, define the volume of classroom A is V, SO,

$$m_v = \frac{0.893V}{0.4615 \cdot 230} \approx 8.41 \times 10^{-3} V$$

$$m_g = \frac{m_v}{90\%} \approx 9.34 \times 10^{-3} V$$

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%		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:

$$\mathrm{q}_{\mathrm{ig},s} = 136 + 2.2A_{cf} + 22N_{OC} = 136 + 2.2 \times 200 + 22 \times 2 = 620W$$

$$\mathrm{q}_{\mathrm{ig,l}} = 20 + 0.22A_{cf} + 12N_{OC} = 20 + 0.22 \times 200 + 12 \times 2 = 88W$$

$$A_{ul} = 1.4cm^2/m^2 \qquad A_{es} = A_{wall} + A_{roof} = 200 + 144 = 344\ m^2$$

$$A_L = A_{es} * A_{ul} = 344 * 1.4 = 481.6\ cm^2$$

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

$$\Delta\, T_{heating} = 20\,°C\ - (4.1\,°C) = 24.1\,°C = 15.9\ K \qquad DR = 7.1\,°C = 7.1\ K$$

$$IDF_{heating} = 0.073\frac{L}{s * cm^2},$$

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

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

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

$$\mathrm{q}_{\mathrm{inf\text{-}cooling}_{\mathrm{sensible}}} = C_{\mathrm{sensible}}Q_{\mathrm{cooling}}\Delta T \approx 1.23 \times 32.893 \times 7.2 \approx 287.25W$$

$$\mathrm{q}_{\mathrm{inf\text{-}cooling}_{\mathrm{latent}}} = C_{\mathrm{sensible}}Q_{\mathrm{cooling}}\Delta T \approx 3010 \times 32.893 \times 0.0039 \approx 386.13W$$

$$\mathrm{q}_{\mathrm{inf\text{-}heatint}_{\mathrm{sensible}}} = C_{\mathrm{sensible}}Q_{\mathrm{heating}}\Delta T \approx 1.23 \times 52.157 \times 15.9 \approx 1020.034W$$