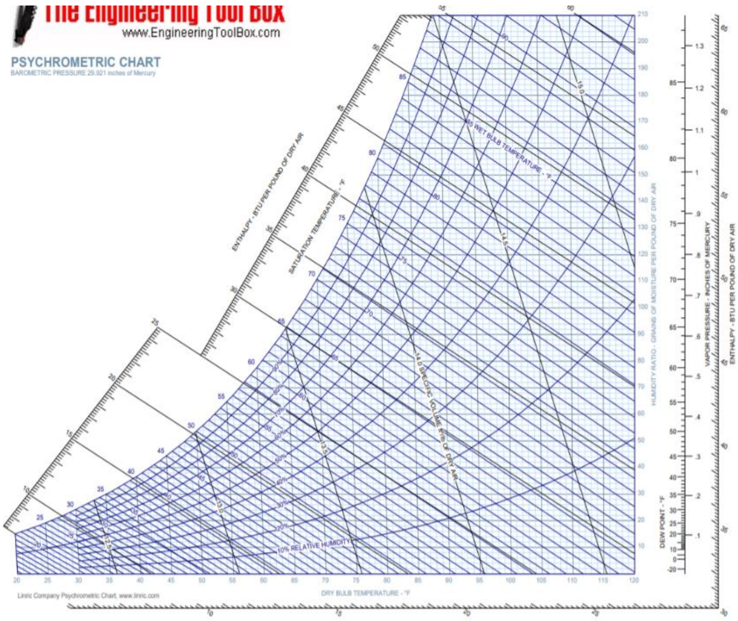
ALESSANDRA BREMBATI 3/12/19

9th *WEEK'S* SUBMISSION

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)

DATA FROM WEBSITE:

Humidity: 90%
Relative humidity (ϕ): 90%
Total air pressure: 101,9 KPa
Atmospheric Pressure: 1019 hPa
Temperature: 7°C -→ 230 K



Starting from a pychrometric chart we can see 4 different values:

- Humidity ratio
- I.E.
- Absolute humidity ω= 0.0055
- Wet bulb temperature T_{wb}= 6°C

We know that

$$\omega = \frac{0.622\,Pv}{Pa} = \frac{0.622\,Pv}{P-Pv} =$$

we can now calculate Pv

Pv = 0.893 kPa

As we have learn in class we already know that Rsp= 0.4615 so we can use this data (and the previous ones) in the following formula:

$$M = \frac{PV}{Rsp\ T}$$

$$M = \frac{0.893\ V}{0.4615*230} = 8{,}41 \text{ X } 10^{-3}\ V$$

Remember that

$$\Phi = \frac{Mv}{Mg} = 90\%$$

So we can find the inverse formula

$$Mg = \frac{Mv}{90\,\%} = 9{,}34 \times 10^{-3}\ v$$

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

$q_{ig,s} = 136 + 2{,}2\ A_{cf} + 22\ N_{oc} = 136 + 2{,}2 \times 200 + 12 \times 2 = 620$ W
$q_{ig,l} = 20 + 0{,}22\ A_{cf} + 12\ N_{oc} = 20 + 0{,}22 \times 200 + 12 \times 2 = 88$ W

House with high construction quality unit leakage area
$A_{ul} = 1{,}4\ cm^2 / m^2$
$A_{es} = A_{wall} + A_{roof} = 200 + 144 = 344\ m^2$
$A_L = A_{es} \times A_{ul} = 344 \times 1{,}4 = 481{,}6\ cm^2$

BRINDISI DATAS:
$T_{cooling} = 24$ °C
$T_{heating} = 20$ °C

$\Delta T_{cooling}$ = 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

$IDF_{heating}$ = 0,073 L / s x cm^2
$IDF_{cooling}$ = 0,033 L / s x cm^2

$Q_{i,heating} = A_L$ x $IDF_{heating}$ = 481,6 x 0,073 = 35,1568 L / s
$Q_{i,cooling} = A_L$ x $IDF_{cooling}$ = 481,6 x 0,033 = 15,8928 L / s

$Q_v = 0{,}05\ A_{cf} + 3{,}5\ (N_{br} + 1)$ = 0,05 x 200 + 3,5 x (1 +1) = 17 L / s

$Q_{i\text{-}v,heating} = Q_{i,heating} + Q_v$ = 35,1568 + 17 = 52,1568 L / s
$Q_{i\text{-}v,cooling} = Q_{i,cooling} + Q_v$ = 15,8928 + 17 = 32,8928 L / s

Csensible = 0,0039

$Q_{inf\text{-}ventilation\_coolingsensible} = C_{sensible} Q_{i\text{-}v,cooling}\ \Delta T_{cooling}$ = 1,23 x 32,8928 x 7,1
$Q_{inf\text{-}ventilation\_coolinglatent} = C_{sensible} Q_{i\text{-}v,cooling}\ \Delta\omega_{cooling}$ = 3010 x 32,8928 x 0,0039
$Q_{inf\text{-}ventilation\_heatingsensible} = C_{sensible} Q_{i\text{-}v,heating}\ \Delta T_{heating}$ = 1,23 x 52,1568 x 24,1