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Task 1

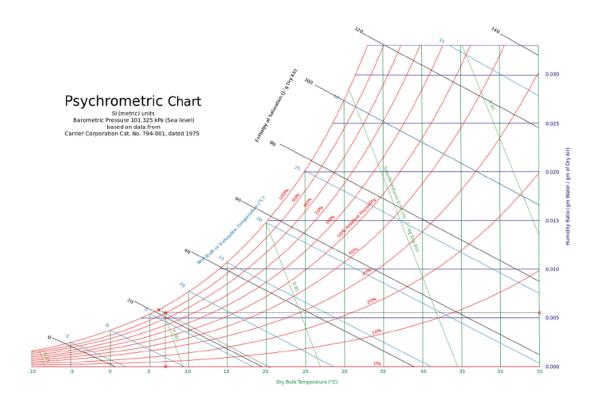*The time now is 20:00, from the data given in the website* https://www.meteo-oggi.it/italia/regione-emilia-romagna/tempo-piacenza/

umidità: 90%, i.e., the relative humidity
ϕ *=90%;*

pressione atmosferica: 1019 hPa, i.e., the total air pressure P =101.9 kPa;

temperatura effttiva: 7
$^{\circ}C$
, i.e., the temperature in Kelvin temperature scale T =230 K

Utilize the psychrometric chart, we can see,

the humidity ratio, i.e., the absolute humidity
ω *= 0.0055*

the web-bulb temperature
Twb = 6 °C

$\because \omega=0.622 \frac{Pv}{Pa}=0.622 \frac{Pv}{P-Pv}=0.0055$, introduce P=101.9 kPa into this equation, and solve it,

Pv≈0.893 kPa

autem, $\phi=\frac{mv}{mg}=90\%$......(1)

for any ideal gas, $m=\frac{PV}{Rsp.T}$, during the class we were told that for water vapour, Rsp.=0.4615

introduce the pressure of water vapor
Pv=0.893 kPa, *and define the volume of aula A is V, here we have:*

$mv=\frac{0.893V}{0.4615*230} \approx 8.41\times10^{-3}V$

subodinate this value to equotion (1), calculate the maximun water vapour mg,

$mg=\frac{mv}{90\%}\approx9.34\times10^{-3}V$

Task 2

Internal gains,

Calculate the sensibile cooling load from internal gains,

qig, s=136+2.2Acf+22Noc=136+2.2*200+22*2=620 W

Calculate the latent cooling load from internal gains,

qig, l=20+0.22Acf+12Noc=20+0.22*200+12*2=88 W

Infiltration,

for a house with a good construction quality, unit leakage area
Aul=1.4cm2/m2

and the exposed surface
Aes=Awall+Aroof=200+144=344 m2

thus,
AL=Aes*Aul=344*1.4=481.6 cm2

Define the cooling temperature $_{Tcooling}$ *=24 °C,*
and heating temperature $_{Theating}$ *=20 °C*

in Brindisi,
[Equazione]

Δ Tcooling=31.1 °C −24 °C=7.1 °C=7.1 K

Δ Theating=20 °C −(−4. 1 °C)=24.1 °C=24.1 K

DR = 7.1 °C=7.1 K

Given that IDFheating=0.073Ls∗cm2,

IDFcooling=0.033Ls∗cm2 ,

Calculate infiltration airflow rate,

Qi, heating=AL∗IDFheating=481.6∗0.073≈35.157Ls

Qi, cooling=AL∗IDFcooling=481.6∗0.033≈15.893Ls

The required miminum whole-building vetilation rate is

Qv=0.05Acf+3.5(Nbr+1)=0.05∗200+3.5∗(1+1)=17Ls

thus,

Qi−v,heating =Qi, heating+Qv≈35.157+17=52.157Ls

Qi−v, cooling=Qi, cooling+Qv≈15.893+17=32.893Ls

Given that
Csensible=1.23 , Clatent=3010, ΔωCooling=0.0039

q.inf−ventilationcoolingsensible=CsensibleQi−v, cooling ΔTCooling≈1.23 ∗32.893∗7.1≈287.25 W

q.inf−ventilationcoolinglatent = ClatentQi−v, cooling ΔωCooling≈3010 ∗32.893 ∗ 0.0039≈386.13 W

q.inf−ventilationheatinggsensible=CsensibleQi−v, heating ΔTheating≈1.23 ∗52.157∗24.1≈1546.09 W