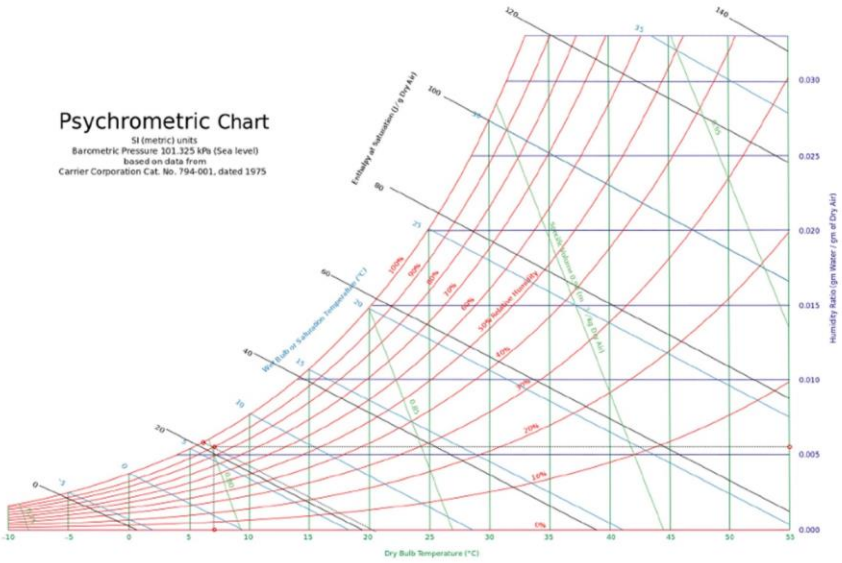
Task 1

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

∵ω=0.622PvPa=0.622PvP−Pv=0.0055, introduce P=101.9 kPa into this equation, and solve it,

Pv≈0.893 kPa

autem, ϕ=mvmg=90%.....(1)

for any ideal gas, m=PVRsp.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=0.893V0.4615∗230 ≈8.41×10−3V

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

mg=mv90%≈9.34 ×10−3V

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 $T_{cooling} = 24\ °C$,
and heating temperature $T_{heating} = 20\ °C$

in Brindisi,
[Equazione]

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

$\Delta T_{heating} = 20\ °C - (-4.1\ °C) = 24.1\ °C = 24.1\ K$

$DR = 7.1\ °C = 7.1\ K$

Given that $IDF_{heating} = 0.073\ Ls * cm2$,

$IDF_{cooling} = 0.033\ Ls * cm2$,

Calculate infiltration airflow rate,

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

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

The required miminum whole-building vetilation rate is

$Q_v = 0.05 A_{cf} + 3.5(N_{br} + 1) = 0.05 * 200 + 3.5 * (1 + 1) = 17\ Ls$

thus,

$Q_{i-v,heating} = Q_{i,\ heating} + Q_v \approx 35.157 + 17 = 52.157\ Ls$

$Q_{i-v,\ cooling} = Q_{i,\ cooling} + Q_v \approx 15.893 + 17 = 32.893\ Ls$

Given that
$C_{sensible} = 1.23$, $C_{latent} = 3010$, $\Delta\omega_{Cooling} = 0.0039$

$q_{inf-ventilation\ cooling\ sensible} = C_{sensible} Q_{i-v,\ cooling}\ \ \Delta T_{Cooling} \approx 1.23 * 32.893 * 7.1 \approx 287.25\ W$

$q_{inf-ventilation\ cooling\ latent} = C_{latent} Q_{i-v,\ cooling}\ \ \Delta\omega_{Cooling} \approx 3010 * 32.893 * 0.0039 \approx 386.13\ W$

$q_{inf-ventilation\ heating\ g\ sensible} = C_{sensible} Q_{i-v,\ heating}\ \ \Delta T_{heating} \approx 1.23 * 52.157 * 24.1 \approx 1546.09\ W$