Question 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)

Weather Forecast Website example

Umidità: Relative humidity, Pressione atmosferica: Air total pressure (1 hPa: 0.1 kPa),

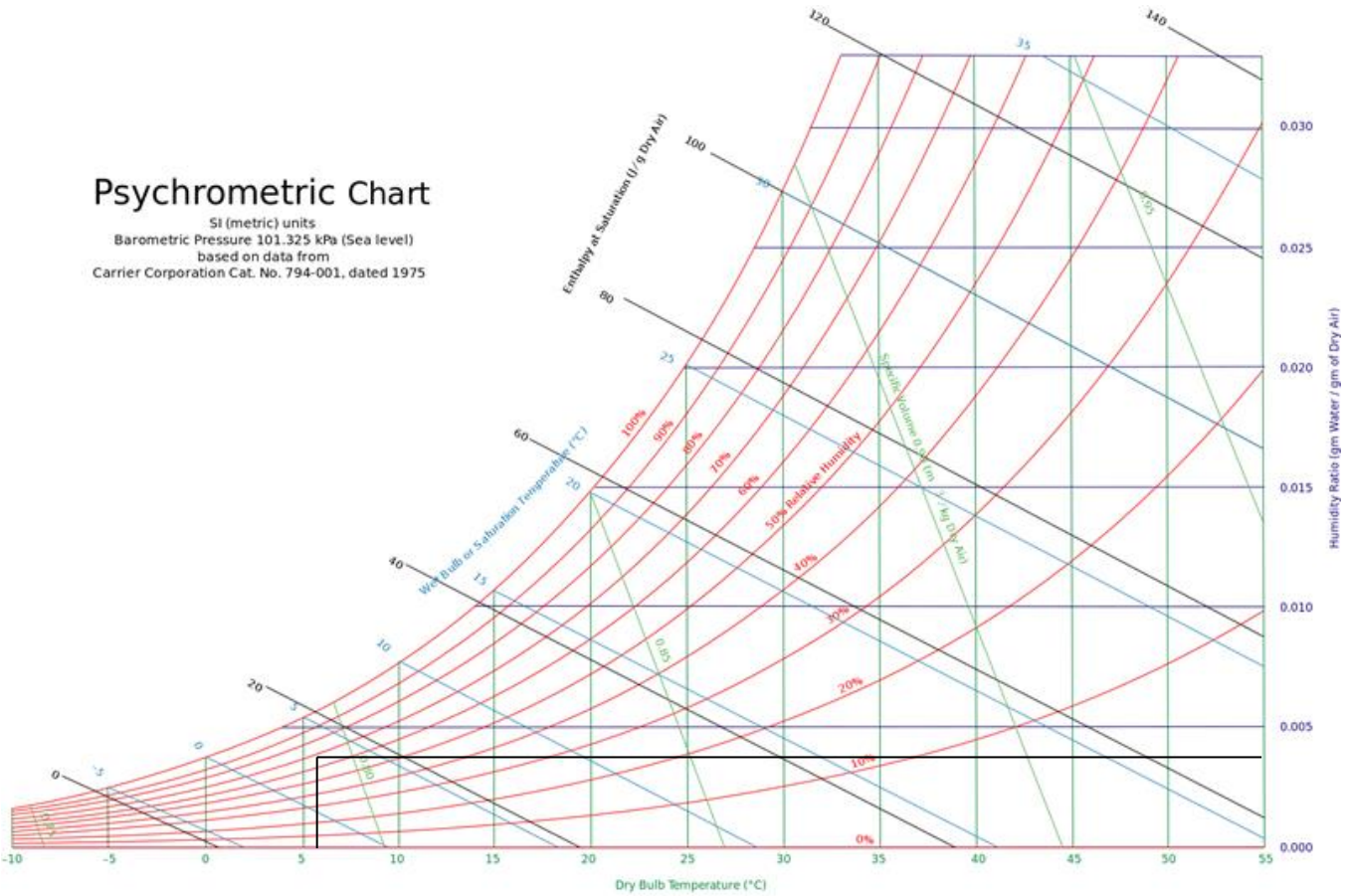
Temperatura effettiva: temperature to be utilized.

Chosen time : 18:00

Relative humidity = 70%

Total air pressure = 1026hPa = 102.6kPa

Temperature =6°C



Absolute humidity =0.0041

$$P_v = \frac{P * \omega}{0.622 * \omega} = \frac{102.6 * 0.0041}{0.622 + 0.0041} = 0.67\text{kPa}$$

$$m_v = \frac{0.67 * V}{0.4615 * (273+6)} = 5.2 * 10^{-3}\ \text{Kg*V}$$

Question 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

INTERNAL GAINS

$$q_{ig,s} = 136 + 2.2A_{cf} + 22N_{oc} = 136 + 2.2 * 200 + 22 * 2 = 620\ W$$

$$q_{ig,l} = 20 + 0.22A_{cf} + 12N_{oc} = 20 + 0.22 * 200 + 12 * 2 = 88\ W$$

INFILTRATION

$$A_{ul} = 1.4\ cm^2/m^2$$

$$A_{es} = A_{wall} + A_{roof} = 200 + 144 = 344\ m^2$$

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

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

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

$$V_{i,heating} = A_L * IDF_{heating} = 481.6*0.065 = 31.30 L/s$$

$$V_{i,cooling} = A_L * IDF_{cooling} = 481.6 * 0.033 = 15.41 L/s$$

$$Qv = 0.05Acf + 3.5(Nbr + 1) = 0.05 * 200 + 3.5 * (1 + 1) = 17\ L/S$$

$$Qi\text{–}v,heating = Qi,heating + Qv = 35.157 + 17 = 48.30\ L/s$$

$$Qi\text{–}v,cooling = Qi,cooling + Qv = 15.893 + 17 = 32.41\ L/s$$

Csensible=1.23, Clatent=3010

$$\Delta T cooling = 31.1\text{-}24 = 7.1°C$$

$$\Delta Theating = 20\text{-}4.1 = 15.9°C$$

$$\omega out = 0.0143\ Kg_{water}/Kg_{DryAir}$$

$$\omega in = 0.0093\ Kg_{water}/Kg_{DryAir}$$

$$\Delta\omega = 0.005\ Kg_{water}/Kg_{DryAir}$$

$$\dot{Q}_{inf-ventilation_{cooling_{sensible}}} = C_{sensible}\dot{V}\Delta T_{Cooling} = 1.23 * 32.41 * 7.1 = 283.04\ W$$

$$\dot{Q}_{\mathrm{inf-ventilation_{cooling_{latent}}}} = C_{\mathrm{latent}}\dot{V}\Delta\omega_{\mathrm{Cooling}} = 3010 * 32.41 * 0.005 = 487.7\ \mathrm{W}$$

$$\dot{Q}_{\mathrm{inf-ventilation_{heatingg_{sensible}}}} = C_{\mathrm{sensible}}\dot{V}\Delta T_{\mathrm{heating}} = 1.23 * 48.3 * 15.9 = 944.6\ \mathrm{W}$$