

WEEK 9 ASSIGNMENT

1. Use a weather forecast website, and utilize the psychrometric chart and the formula we went through in the class to determine the absolute 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),

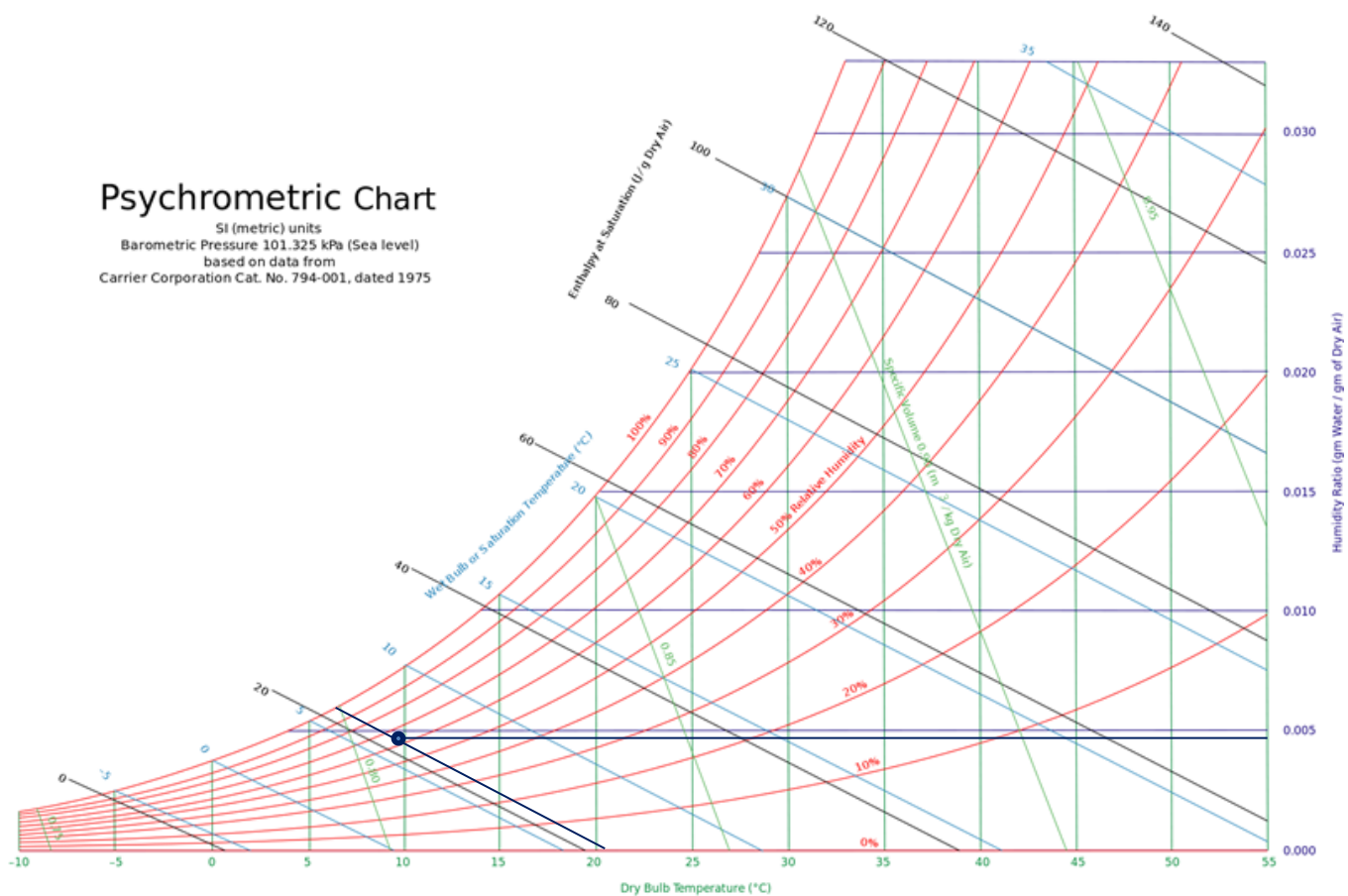
Temperatura effettiva: temperature to be utilized.

Chosen time : 14:00

Relative humidity = 62%

Total air pressure = 1026hPa = 102.6kPa

Temperature = 7°C



Absolute humidity (ω) = 0.0045

$$P_v = \frac{P * \omega}{0.622 * \omega} = \frac{102.6 * 0.0045}{0.622 * 0.0045} = 0.737 \text{ kPa}$$

$$m_v = \frac{0.73 * V}{0.4615 * (280,15)} = 0,00564 = 5.64 * 10^{-3} \text{ kg} \cdot V$$

$$m_g = \frac{m_v}{62\%} = 0,00909$$

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

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

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

INFILTRATION

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

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

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

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

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

$$V_{i,heating} = A_L * IDF_{heating} = 481.6 * 0.073 = 35.157 \text{ L/s}$$

$$V_{i,cooling} = A_L * IDF_{cooling} = 481.6 * 0.033 = 15.993 \text{ L/s}$$

$$Q_v = 0.05A_{cf} + 3.5(N_{br} + 1) = 0.05 * 200 + 3.5 * (1 + 1) = 17 \text{ L/s}$$

$$Q_{i-v,heating} = Q_{i,heating} + Q_v = 35.157 + 17 = 52.157 \text{ L/s}$$

$$Q_{i-v,cooling} = Q_{i,cooling} + Q_v = 15.993 + 17 = 32.993 \text{ L/s}$$

$$C_{sensible} = 1.23, C_{latent} = 3010$$

$$\Delta T_{cooling} = 31.1 - 24 = 7.1^\circ\text{C}$$

$$\Delta T_{heating} = 20 - 4.1 = 15.9^\circ\text{C}$$

$$\omega_{out} = 0.0143 \text{ Kg}_{water}/\text{Kg}_{DryAir}$$

$$\omega_{in} = 0.0093 \text{ Kg}_{water}/\text{Kg}_{DryAir}$$

$$\Delta \omega = 0.005 \text{ Kg}_{water}/\text{Kg}_{DryAir}$$

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

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

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