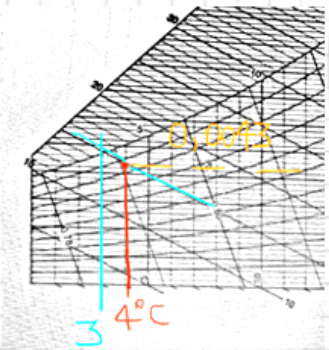
WEEK 9 ASSIGNMENT // Andrea Foppiani

T1 Use a weather forecast website and utilize the PSYCHROMETRIC CHART and 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 of Piacenza campus now.

- meteo-oggi.it

TUESDAY 3/12/2019 - 10.00 pm

- effective temperature: 4°C (T)
- atmospheric pressure: 1028 hPa (P)
- relative humidity: 85% (ϕ)



(consulting the psychrometric chart...)

a) ABSOLUTE HUMIDITY (W) = 0,0043 $\left(\frac{Kg\ vapour}{Kg\ dry\ air}\right)$

b) WET-BULB TEMPERATURE = 3°C

c) MASS OF WATER VAPOUR (m_V)

$\left(m_V = \frac{P_V V_V}{R_V T}\right)$ $\quad T = (4+273)\,K = 277\,K$

$\phi = \frac{m_V}{m_g} = \frac{P_V}{P_g}$

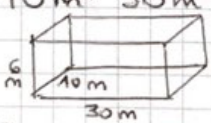
At 4°C, $P_g = 0,81$ kPa

(from saturated steam - temperature table)

$P_V = \phi \cdot P_g = 0,85 \cdot 0,81\ kPa = 0,6885\ kPa$

$R_V = 0,4615$

V (classroom A) = $10m \cdot 30m \cdot 6m = 1800 m^3$



$m_V = \frac{0,6885 \cdot 1800}{0,4615 \cdot 277} = 9,6945\ Kg$

T2 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

ROOM HEIGHT $h = 2,5\ m$
(good construction quality)

2 occupants, 1 bedroom
conditioned floor area $= 200\ m^2$
wall area $= 144\ m^2$

INTERNAL GAINS:

$$\dot{Q}_{ig_{sensible}} = 136 + 2,2 \cdot A_{cf} + 22 \cdot N_{oc} = 136 + 2,2 \cdot 200 + 22 \cdot 2 = \boxed{620\ W}$$

$$\dot{Q}_{ig_{latent}} = 20 + 0,22 \cdot A_{cf} + 12 \cdot N_{oc} = 20 + 0,22 \cdot 200 + 12 \cdot 2 = \boxed{88\ W}$$

INFILTRATION:

A_{es} (exposed surface area) $= 200 + 144 = 344\ m^2$

A_{ul} (unit leakage area) for good quality constr. $= 1,4\ \frac{cm^2}{m^2}$
↑ [table]

Leakage area → $A_L = A_{es} \cdot A_{ul} = 344 \cdot 1,4 = \boxed{481,6\ cm^2}$

VENTILATION:

$$V_V = 0,05 \cdot A_{cf} + 3,5 \cdot (N_{br} + 1) = 0,05 \cdot 200 + 3,5 \cdot (1+1) = 17\ \frac{L}{s}$$

$$\rightarrow \dot{V}_{inf\text{-}ventilation_{heating}} = 31,304 + 17 = 48,304\ \frac{L}{s}$$

$$\rightarrow \dot{V}_{inf\text{-}ventilation_{cooling}} = 15,266 + 17 = 32,266\ \frac{L}{s}$$

$C_{sensible} = 1,23$, $C_{latent} = 3010$

$$\Rightarrow \dot{Q}_{inf\text{-}ventilation_{cooling\ sensible}} = C_{sensible} \cdot \dot{V} \cdot \Delta T_{cooling} = 1,23 \cdot 32,266 \cdot (31,1 - 24) = \boxed{281,779\ W}$$

$$\Rightarrow \dot{Q}_{inf\text{-}ventilation_{heating\ sensible}} = C_{sensible} \cdot \dot{V} \cdot \Delta T_{heating} = 1,23 \cdot 48,304 \cdot (20 - 4,1) = \boxed{944,681\ W}$$

Latent load calculation

↳ we need $\Delta w_{cooling}$

[psychrometric chart] → DB = 31,1 °C
WB = 24,3 °C

$w_{out} = 0,016$

$w_{in} = 0,0093$

$\Delta w_{cooling} = 0,0067$

$$\Rightarrow \dot{Q}_{\substack{inf-ventilation \\ cooling \\ latent}} = c_{latent} \cdot \dot{V} \cdot \Delta w_{cooling} =$$

$$= 3010 \cdot 32,266 \cdot 0,0067 = \boxed{650,708\ W}$$