A=10\*25\*5 T=10 P=100kpa 
$$\phi = 65\%$$

$$\phi = \frac{m_v}{m_g} = \frac{P_v}{P_g} \longrightarrow P_g = P_{sat} 10 \,^{\circ}C = 1.2276 \, kPa$$

$$\phi = \frac{P_v}{P_g} \rightarrow P_V = \phi \times P_g = 0.65 * 1.2276 = 0.7979 \ kPa$$

$$P_g = P - P_v = 100 \ kPa - 0.80 \ kPa = 99.20 \ kPa$$

$$\omega = 0.622 \frac{P_v}{P_a} = 0.622 \frac{0.80}{99.20} = 0.005 \frac{Kg_{vapour}}{kg_{drvAir}}$$

$$R_a = 0.287, R_v = 0.4615$$

$$m_a = \frac{99.20 * (10 * 25 * 5)}{0.287 * (273 + 10)} = 1526.70 \ kgof \ dry \ air$$

$$m_v = \frac{0.80 * (10 * 25 * 5)}{0.4615 * (273 + 10)} = 7.66 \ kg$$

$$h_a = 1.005 * T = 1.005 * 10 = 10.05 \frac{kJ}{kg_{dryAir}}$$

$$h_v = 2501.3 + 1.82 * 10 = 2519.5 \frac{kJ}{kg_{water}}$$

$$h_{\square} = h_a + \omega h_v = 10.05 + 0.005 * 2519.5 = 22.65 \frac{kJ}{kg_{dryAir}}$$

Task 2

Internal gains

$$\begin{split} \dot{Q}_{ig_{sensible}} &= 136 + 2.2 * A_{cf} + 22 \; N_{oc} = 136 + 2.2 * 200 + 22 * 2 = 620 \; W \\ \dot{Q}_{ig_{latent}} &= 20 + 0.22 * A_{cf} + 12 \; N_{oc} = 20 + 0.22 * 200 + 12 * 2 = 88 \; W \end{split}$$

Table 3 Unit Leakage Areas

Construction	Description	A <sub>ef</sub> , cm <sup>2</sup> /m <sup>2</sup> 0.7 1.4	
Tight	Construction supervised by air-sealing specialist		
Good	Carefully sealed construction by knowledgeable builder		
Average	Typical current production housing	2.8	
Leaky	Typical pre-1970 houses	5.6	
Very leaky	Old houses in original condition	10.4	

Good quality -> 
$$A_{ul} = 1.4 \frac{cm^2}{m^2}$$

Exposed surface = Wall area +roof area

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

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

н.	Heating Design Temperature, °C				Cooling Design Temperature, °C				
m	-40	-30	-20	-10	0	10	30	35	40
2.5	0.10	0.095	0.086	0.077	0.069	0.060	0.031	0.035	0.040
3	0.11	0.10	0.093	0.083	0.072	0.061	0.032	0.038	0.043
4	0.14	0.12	0.11	0.093	0.079	0.065	0.034	0.042	0.049
5	0.16	0.14	0.12	0.10	0.086	0.069	0.036	0.046	0.055
6	0.18	0.16	0.14	0.11	0.093	0.072	0.039	0.050	0.061
7	0.20	0.17	0.15	0.12	0.10	0.075	0.041	0.051	0.068
8	0.22	0.19	0.16	0.14	0.11	0.079	0.043	0.058	0.074

$$IDF_{heating} = 0.073 \frac{L}{s. cm^2}$$
  $IDF_{cooling} = 0.033 \frac{L}{s. cm^2}$ 

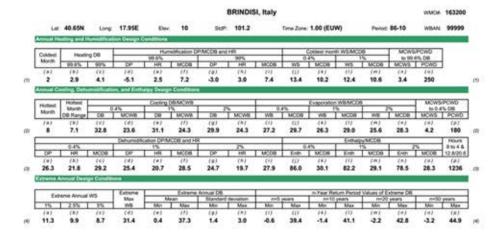
$$IDF_{cooling} = 0.033 \frac{L}{s. cm^2}$$

$$\dot{V}_{infiltration_{heating}} = A_L \times IDF$$

$$= 481.6 * 0.073 = 35.16 \frac{L}{S}$$

$$\dot{V}_{infiltration_{cooling}} = A_L \times IDF = 481.6 * 0.033$$
  
=  $15.89 \frac{L}{s}$ 





$$\dot{V}_{ventilation}$$
  
= 0.05  $A_{cf}$  + 3.5  $(N_{br}$  + 1) = .05\*200+ 3.5\* 2 = 17 L/S

$$\dot{V}_{inf-ventilation_{heating}} = 35.16 + 17$$
  
= 52.16 L/s

$$\dot{V}_{inf-ventilation_{cooling}}$$
  
= 15.89 + 17 = 32.89 L/s

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

$$\dot{Q}_{inf-ventilation_{cooling_{sensible}}} = C_{sensible} \dot{V} \Delta T_{Cooling}$$
  
= 1.23 \* 32.89 \* (31.1 - 24.3) = 275.09 W

$$\begin{split} \dot{Q}_{inf-ventilation_{heatingg_{sensible}}} &= C_{sensible} \dot{V} \Delta T_{heating} \\ &= 1.23 * 52.16 * (20 - 4.1) = 1020.09 \, W \end{split}$$

