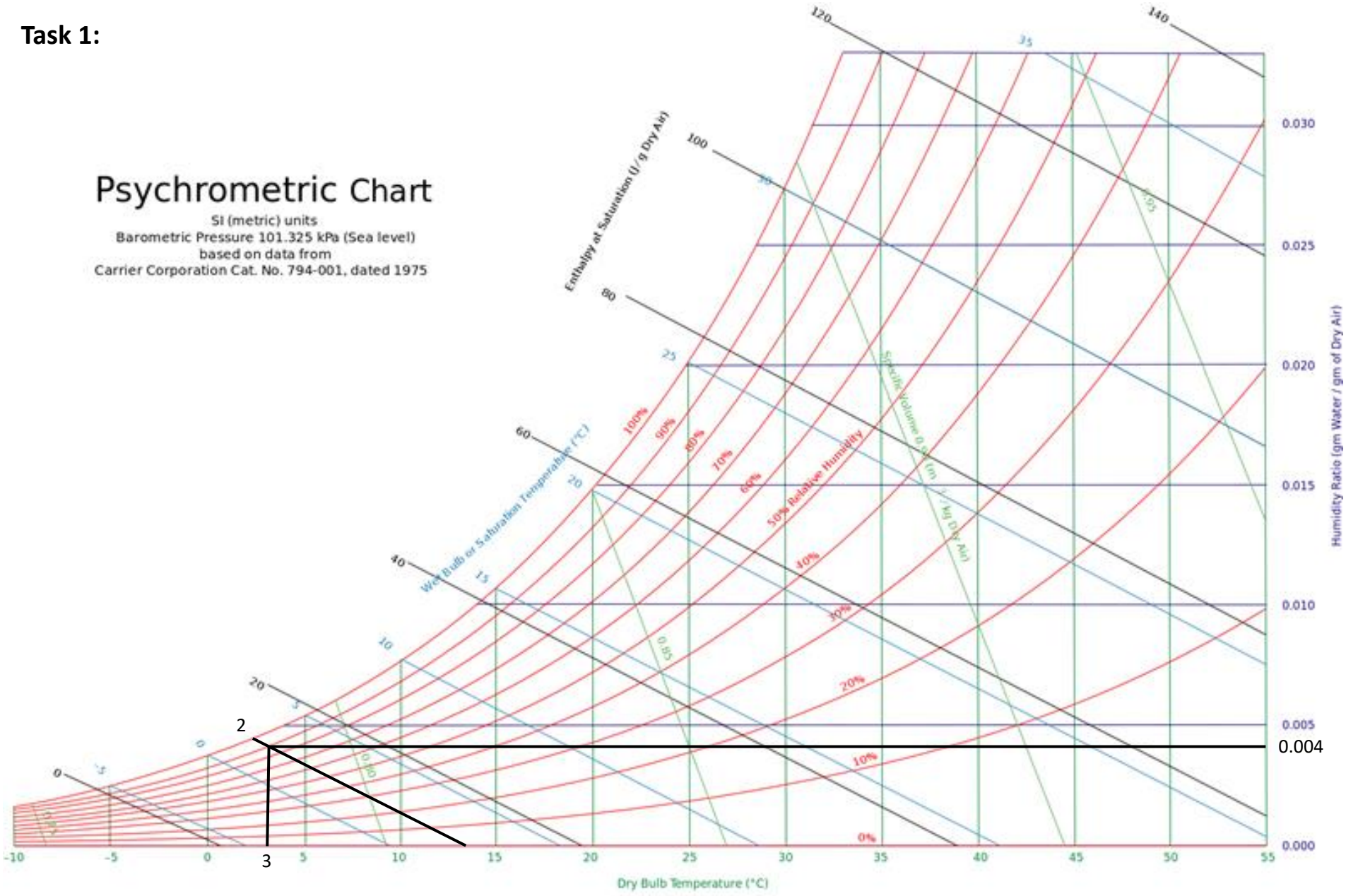
Task 1:


Psychrometric Chart
SI (metric) units
Barometric Pressure 101.325 kPa (Sea level)
based on data from
Carrier Corporation Cat. No. 794-001, dated 1975
Enthalpy at Saturation (J / g Dry Air)
Wet Bulb or Saturation Temperature (°C)
Specific Volume (m³ / kg Dry Air)
100%
90%
80%
70%
60%
50% Relative Humidity
40%
30%
20%
10%
0%
Humidity Ratio (gm Water / gm of Dry Air)
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.004
2
3
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55
Dry Bulb Temperature (°C)

The relative humidity ϕ=89%
Atmospheric pressure P=102.8 KPa
Effective temperature T= 3°C= 276 K

From the psychrometric chart,
We can find the absolute humidity ω=0.004
The web-bulb temperature T_{wb}= 2°C

$\omega=0.622P_v/P_a=0.622P_v/(P-P_v)=0.004$
P=102.8 kPa
So, P_v= 0.657 kPa

ϕ=89%= m_v/m_g
if the volume of Aula A= 800 m^3
$m_v=PV/R_{sp}T=0.657*800/(0.4615*276)=4.126$
so, $m_g=m_v/0.89=4.636$

Task2：

Internal gains:

Sensible cooling load: Q_{igs}= 136+2.2A_{cf}+22N_{oc}= 136+ 2.2*200+ 22*2= 620 W

Latent cooling load: Q_{igl}= 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

So, A_L= A_{es}* A_{ul}= 344* 1.4= 481.6 cm^2

In Brindisi,

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

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

DR=7.1℃

We know that:

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

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

So, $Q_{icooling}$=A_L* $IDF_{cooling}$= 481.6*0.033=15.89 L/s

$Q_{iheating}$=A_L* $IDF_{heating}$= 481.6*0.073=35.16 L/s

The minimum whole building ventilation rate is:

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

So, $Q_{i\text{-}vcooling}= Q_{icooling}+ Q_v=15.89+17= 32.89$ L/s
$Q_{i\text{-}vheating}= Q_{iheating}+ Q_v=35.16+17= 52.16$ L/s

We know that: $C_{sensible}=1.23$, $C_{latent}=3010$, $\Delta\ \omega_{cooling}=0.0039$
So, $Q_{inf\text{-}v\ cooling\ sensible}= C_{sensible}Q_{i\text{-}vcooling}\ \Delta\ T_{cooling}= 1.23*32.89*7.1= 287.22$ W
$Q_{inf\text{-}v\ cooling\ latent}= C_{latent}\ Q_{i\text{-}vcooling}\ \Delta\ \omega_{cooling} = 3010*32.89*0.0039= 386.10$ W
$Q_{inf\text{-}v\ heating\ sensible}= C_{sensible}Q_{i\text{-}vheating}\ \Delta\ T_{heating}= 1.23*52.16*24.1= 1546.18$ W