WEEK 9 ASSIGNMENT

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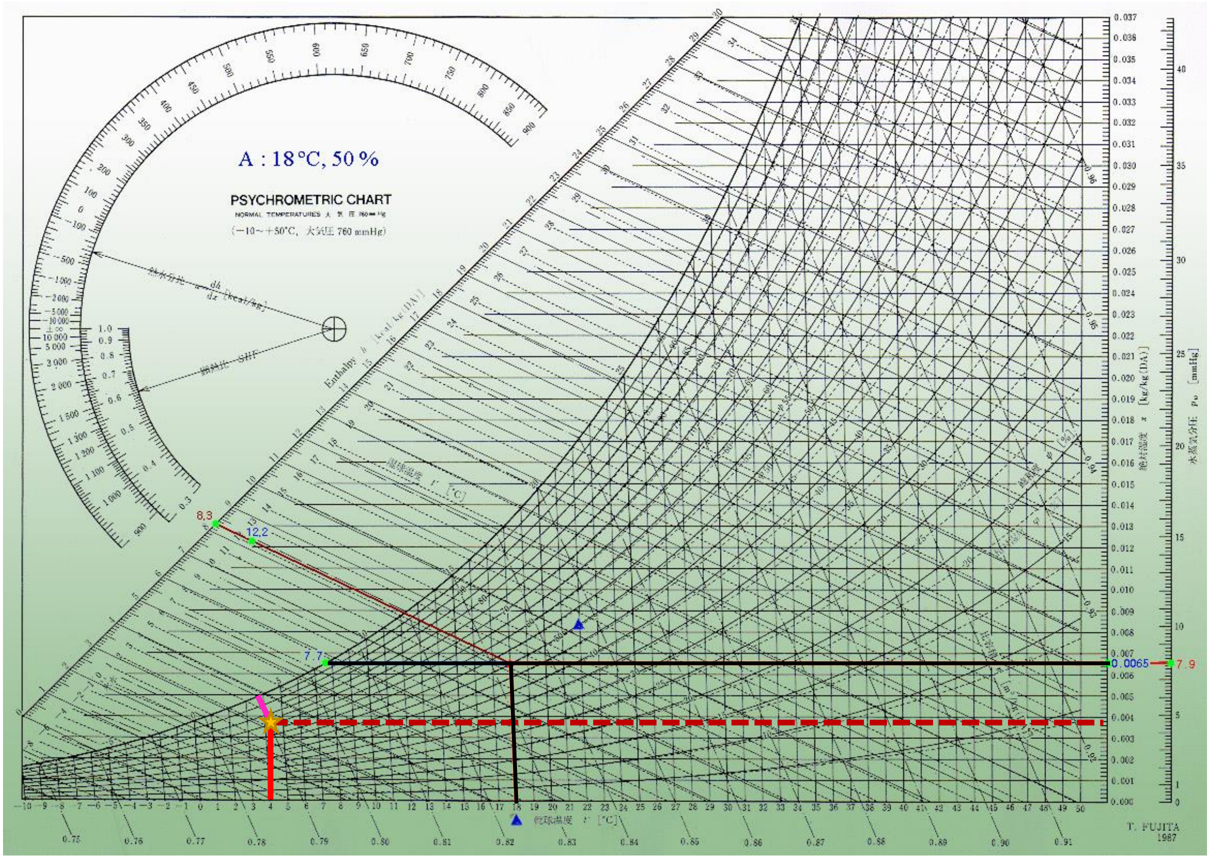
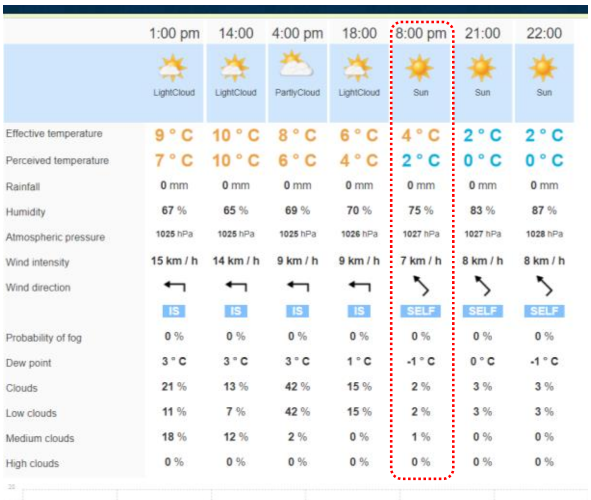
QUESTION 1

Use a weather forecast website, and utilize the psychometric 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.

ANSWER:





	1:00 pm	14:00	4:00 pm	18:00	8:00 pm	21:00	22:00
	LightCloud	LightCloud	PartlyCloud	LightCloud	Sun	Sun	Sun
Effective temperature	9 ° C	10 ° C	8 ° C	6 ° C	4 ° C	2 ° C	2 ° C
Perceived temperature	7 ° C	10 ° C	6 ° C	4 ° C	2 ° C	0 ° C	0 ° C
Rainfall	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm	0 mm
Humidity	67 %	65 %	69 %	70 %	75 %	83 %	87 %
Atmospheric pressure	1025 hPa	1025 hPa	1025 hPa	1026 hPa	1027 hPa	1027 hPa	1028 hPa
Wind intensity	15 km / h	14 km / h	9 km / h	9 km / h	7 km / h	8 km / h	8 km / h
Wind direction	IS	IS	IS	IS	SELF	SELF	SELF
Probability of fog	0 %	0 %	0 %	0 %	0 %	0 %	0 %
Dew point	3 ° C	3 ° C	3 ° C	1 ° C	-1 ° C	0 ° C	-1 ° C
Clouds	21 %	13 %	42 %	15 %	2 %	3 %	3 %
Low clouds	11 %	7 %	42 %	15 %	2 %	3 %	3 %
Medium clouds	18 %	12 %	2 %	0 %	1 %	0 %	0 %
High clouds	0 %	0 %	0 %	0 %	0 %	0 %	0 %

a) Absolute Humidity

From the chart, taking dry bulb temperature as 4°C and relative Humidity as 75%, the specific humidity is 0.0037.

By formula Method

$\Phi = m_v/m_g$

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$= P_v/P_g$ ($P_v = P_{sat}$ @4°C = 0.8132 Kpa)

Partial pressure of water vapour

$\Phi = P_v/P_g$

$P_v = \Phi \times P_g$

$\mathbf{P_v}$ = 0.75 x 0.8132 = **0.6099 Kpa**

$P_a = P - P_v$

$\mathbf{P_a}$ = 102.7kPa – 0.6099 = **102.0901 kPa**

$\omega = 0.622(P_v/P_a)$

$\omega = 0.622 \times 0.6099/102.0901$

ω=0.00368 Kg vapour/Kg dry air

b) **Wet bulb temperature**

From the chart, taking dry bulb temperature as 4°C and relative Humidity as 75%, the specific humidity is **2°C.**

c) **Mass of water vapour in the air (m_v) (taking classroom dimensions as 20mx5mx5m**

$M_v = P_v x V_v / R_v x T$

m_v= 0.6099x(20x5x5) / 0.4615 x (4+273)

m_v=2.38kg

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.

ANSWER:

a) **Internal Gains**

$\mathbf{Q_{ig.sensible}} = 136+2.2A_{cf}+22N_{oc}$

= 136+2.2.200+22.2

= 620W

$\mathbf{Q_{ig.latent}} = 20+0.22A_{cf}+12\ N_{oc}$

= 20+0.22x200+12x2

= 88W

b) **Infiltration**

$Q_i = A_L$. IDF

A_{UL} = 1.4cm²/m² (From the table)

Exposed surface = Wall area + roof area

A_{es}= 200+144

A_{es}= 344m²

$\mathbf{A_L} = A_{es} x A_{UL}$ = 344 x 1.4

= **481.6cm²**

Infiltration rate

$Q_i = A_i$ x IDF

$IDF_{heating}$ = 0.065 L/s

$IDF_{cooling}$ = 0.032 L/s

Infiltration Rate- Winter

$\mathbf{V_{iheating}}$ = (481.6cm2) (0.065 L/s)

= **35.156 L/s**

$\mathbf{V_{icooling}}$ = (481.6cm2) (0.0375 L/s)

= **18.06 L/s**

c) **Ventilation**

$Q_v = 0.05\ A_{cf} + 3.5\ (N_{br}+1)$

V(dot) $_{\textbf{Ventilation}}$ = (0.05x200) + (3.5x(1+1)) = **17.0L/s**

V(dot) $_{\textbf{infiltration-ventilation heating}}$ = 31.30 L/s + 17 L/s

= **48.3 L/s**

V(dot) $_{\textbf{infiltration-ventilation cooling}}$ = 15.41 L/s + 17 L/s

= **32.41 L/s**

Sensible and Latent load

$C_{sensible} = 1.23$

$C_{latent} = 3010$

$\Delta T_{heating}$ = 20°C – 4.1°C = **15.9°C**

$\Delta T_{cooling}$ = 31.1°C – 24°C = **7.1°C**

Q(dot) $_{\textbf{i-v heating sensible}}$ = $C_{sensible} V(dot)\ \Delta T_{heating}$

= 1.23 x 48.3 x 15.9

= **944.60W**

Q(dot) $_{\textbf{i-v cooling sensible}}$ = $C_{sensible} V(dot)\ \Delta T_{cooling}$

= 1.23 x 32.41 x 7.1

= **283.04W**

Q(dot) $_{\textbf{i-v cooling latent}}$ = $C_{latent} V(dot)\ \Delta\omega_{cooling}$

= 3010 x 32.41 x (0.014-0.0095)

= **438.99W**