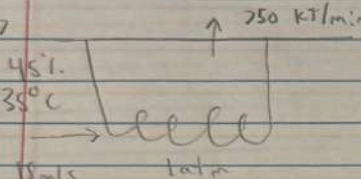
HW 3.5

14-60 4 ppl · 0.25 kg/person = 10 kg/day $Q = m h_{fg}$ = 1(2450 kJ/kg) = 2450 kJ

14-67 

$h_1 = 71$ kJ/kg dry air $\omega_1 = 0.0159$ kg H_2O/kg d

$v_1 = 0.893$ m³/kg

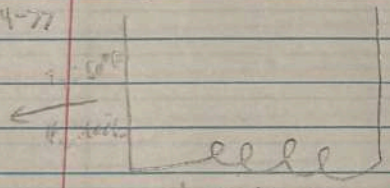
$A = \frac{\pi D^2}{4} = 0.077\ m^2$ $\dot{V} = A v_1 = 1.27\ m^3/s$

$M_a = \frac{\dot{V}_1}{v_1} = 1.424$ kg/s 250 kJ/min = 12.5 kg/s

$h_2 = h_1 - \frac{q_{out}}{M_a} = 71.0 - \frac{12.5}{1.424} = 62.22$ kJ/kg $\omega = 0.0159$

Using chart: $T_2 = 26.3$ C $\phi_2 = 72.4\%$

$v_2 = 0.867\ m^3/kg$ $V_2 = \frac{M_a v_2}{A} = 17.5$ m/s

14-77 

Using chart

$T_1 = 90°F$ $\omega_1 = 0.028$ lbm/lbm $h_1 = 52.2$ Btu/lbm

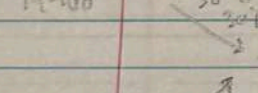
$\phi_1 = 90\%$ $\omega_2 = 0.0175$ lbm/lbm $h_2 = 20.3$ Btu/l

$T_w = 28.08$ Btu/lbm

$q_{out} = h_1 - h_2 - (\omega_1 - \omega_2) h_w$

$q_{out} = 31.37$ Btu/lbm dry air

Profitable?

14-100 

$\dot{V}_1 = 15\ m^3/min$ $\dot{V}_2 = 25\ m^3/min$

$M_{a_1} = \frac{\dot{V}_1}{v_1}$ $M_{a_2} = \frac{\dot{V}_2}{v_2}$ $v_1 = 0.89\ m^3/kg$

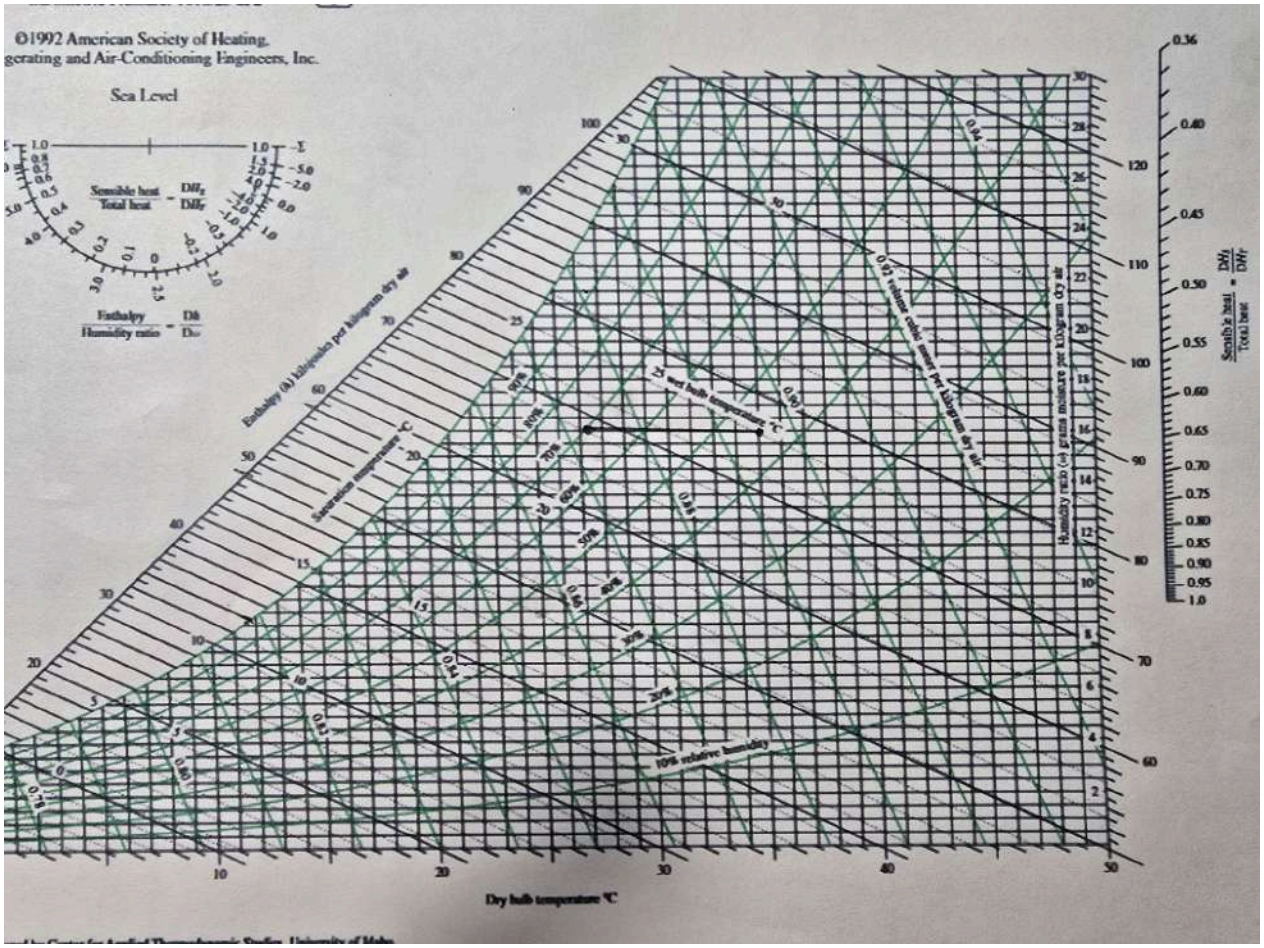
$v_2 = 0.819\ m^3/kg$

$M_{a_1} = \frac{15\ m^3/min}{0.89} = 16.85$ kg dry air/min $M_{a_2} = 30.525$

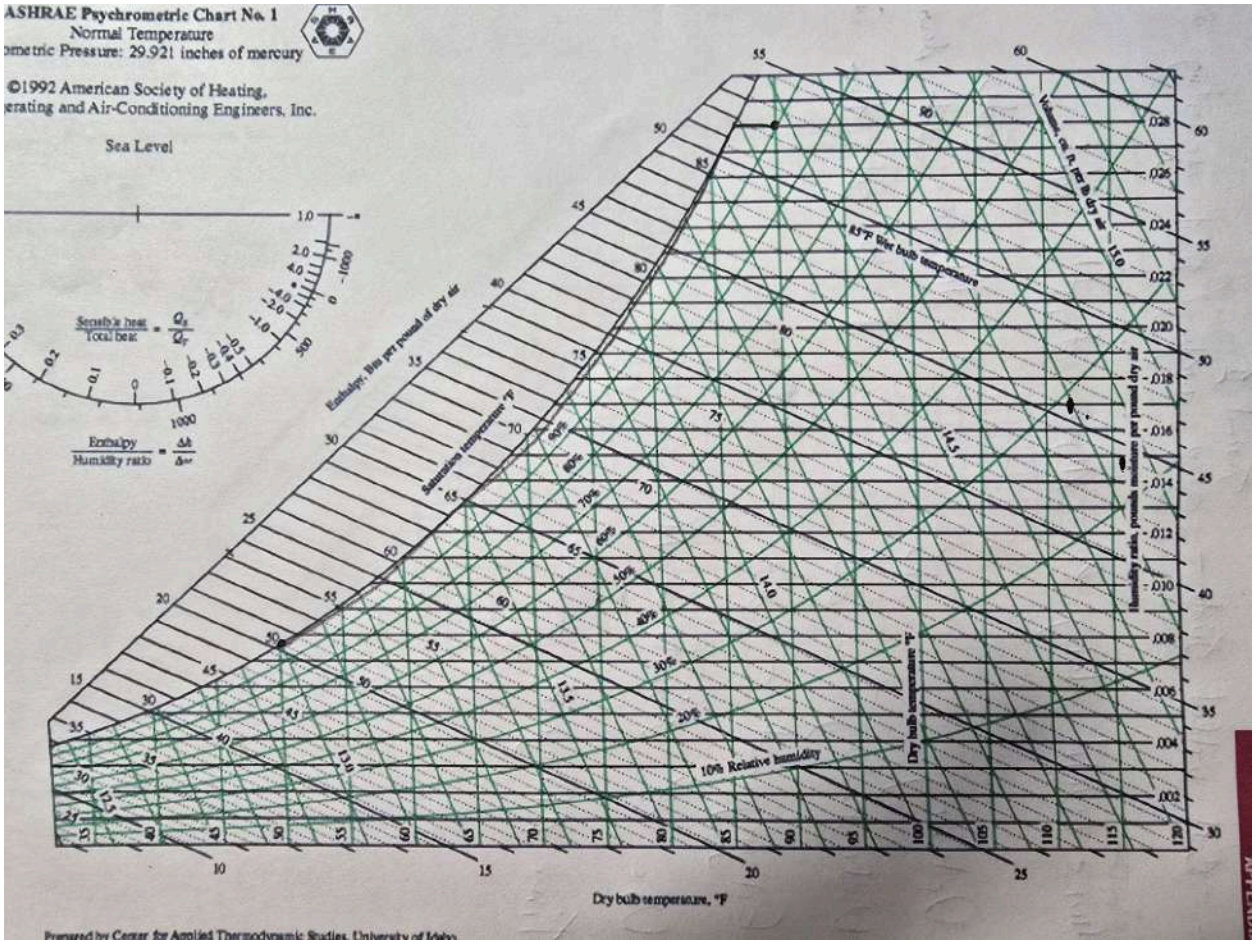
$\omega_3 = \frac{\omega_2 - \omega_1}{\frac{M_{a_1}}{M_{a_2}} + 1} + \omega_1$ $\omega_1 = 0.008$ $\omega_2 = 0.01$ $v_3 = 0.841$

$\phi_3 = 64\%$ $T_3 = 20.5°C$ $M_{a_3} = 47.375$

$\omega_3 = 0.081$ kg H_2O/kg dry air $\dot{V}_3 = M_{a_3} v_3 = 39.84$



Psychrometric for 14-60



Psychrometric for 14-73

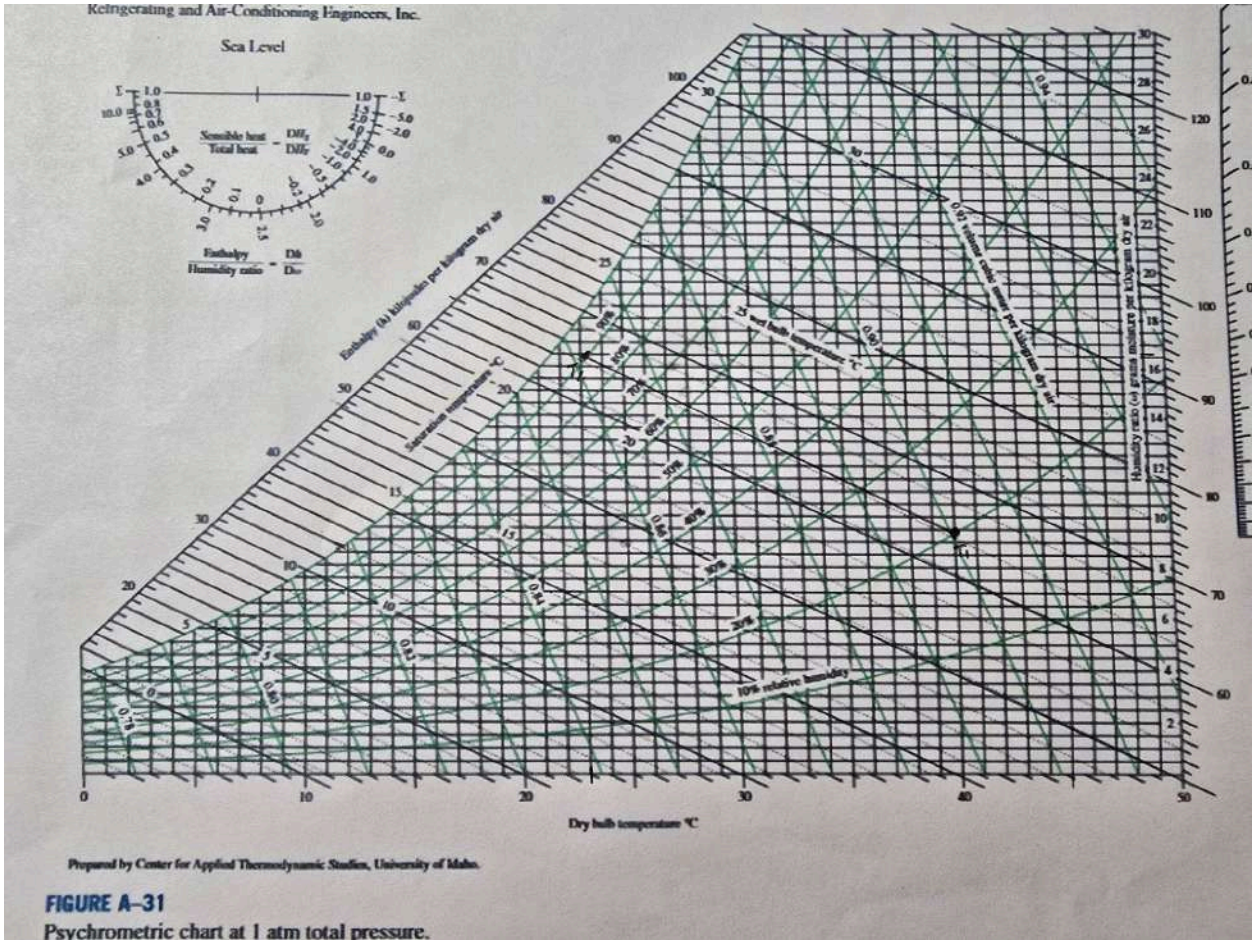
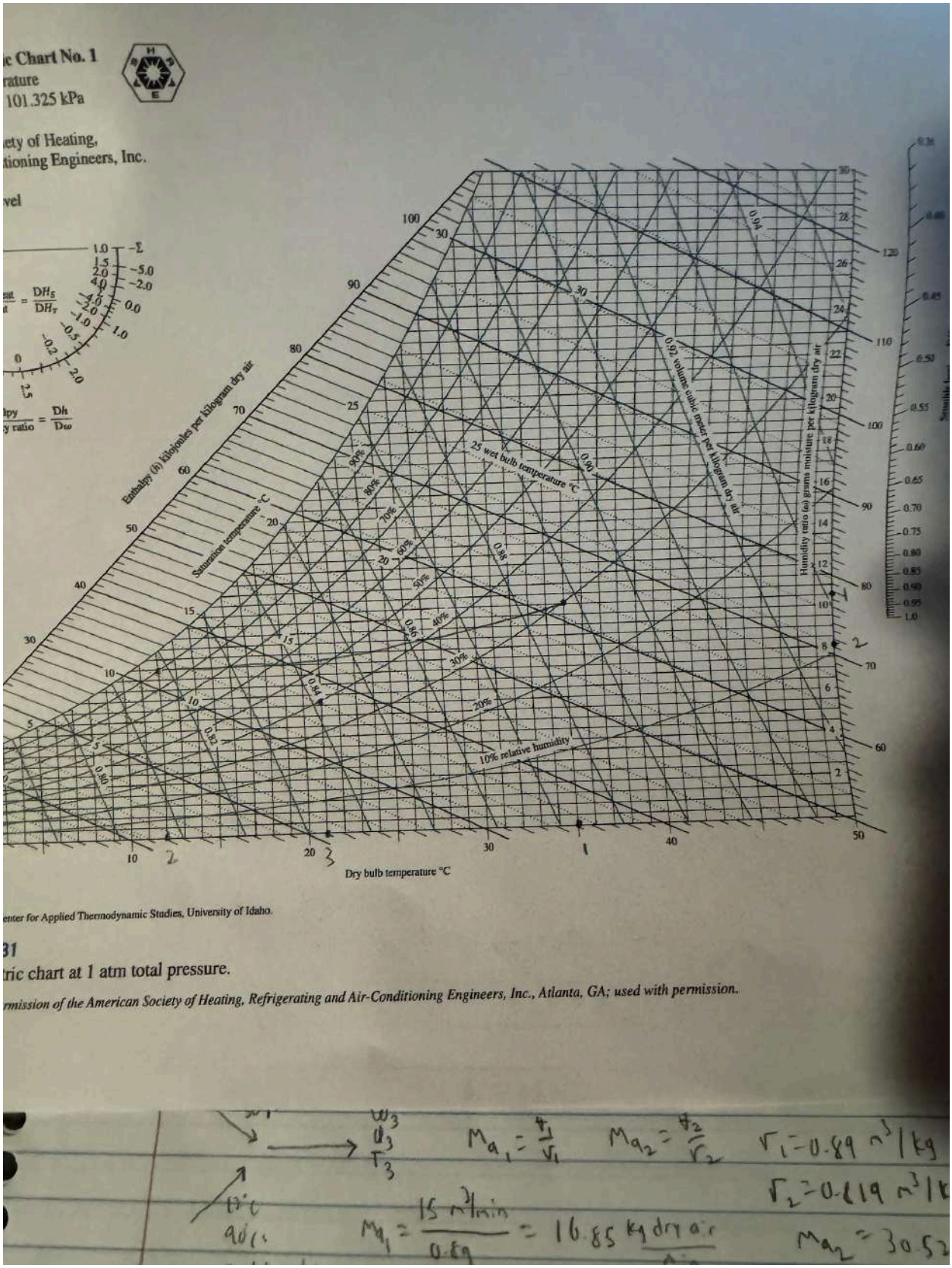


FIGURE A–31
Psychrometric chart at 1 atm total pressure.

Psychrometric for 14-93



31

tric chart at 1 atm total pressure.

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Psychrometric for 14-100

14-93 $T_1 = 40°C$ $\omega_1 = 0.009$ $V_1 = 0.9$ $\phi_2 = 90\%$ $\omega_2 = 0.017$
$\phi_1 = 20\%$ $h_1 = 65$ $T_2 = 23°C$

$$\dot{m}_{da} = \frac{\dot{V}}{V_1} = \frac{7}{0.9} = 7.78 \text{ kg/min}$$

$$\dot{m}_w = \dot{m}_{da}(\omega_2 - \omega_1) = \dot{m}_w = 7.78(0.017 - 0.009) = 0.622 \text{ kg/min}$$

14-109 $\dot{m}_w = 60 \text{ kg/s}$ $T_{w\,out} = 33°C$ Inlet: $T_{a\,dry_1} = 22°C$ outlet: $T_{a\,wet_2} = 30°C$
$T_w = 40°C$ $T_{a\,wet_1} = 18°C$ $\phi_2 = 95\%$
$\omega_1 = 0.009$ $\omega_2 = 0.026$
$\dot{Q} = \dot{m}_w c_p \Delta T$ $h_1 = 45$ $h_2 = 97$
$\dot{Q} = 60 \cdot 4.18 \cdot 7 = 1754.4 \text{ kW}$ $V_1 = 0.848$ $V_2 = 0.885$

$$\dot{Q} = \dot{m}_{da}(h_2 - h_1) \quad 1754.4 = \dot{m}_{da}(97 - 45)$$
$$\dot{m}_{da} = 33.74 \text{ kg/s}$$

a) $\dot{V}_1 = 33.74 \cdot 0.848 = 28.6 \text{ m}^3/\text{s}$

$$\dot{m}_{evap} = \dot{m}_{da}(\omega_2 - \omega_1) = 33.74(0.026 - 0.009) = 0.574 \text{ kg/s}$$

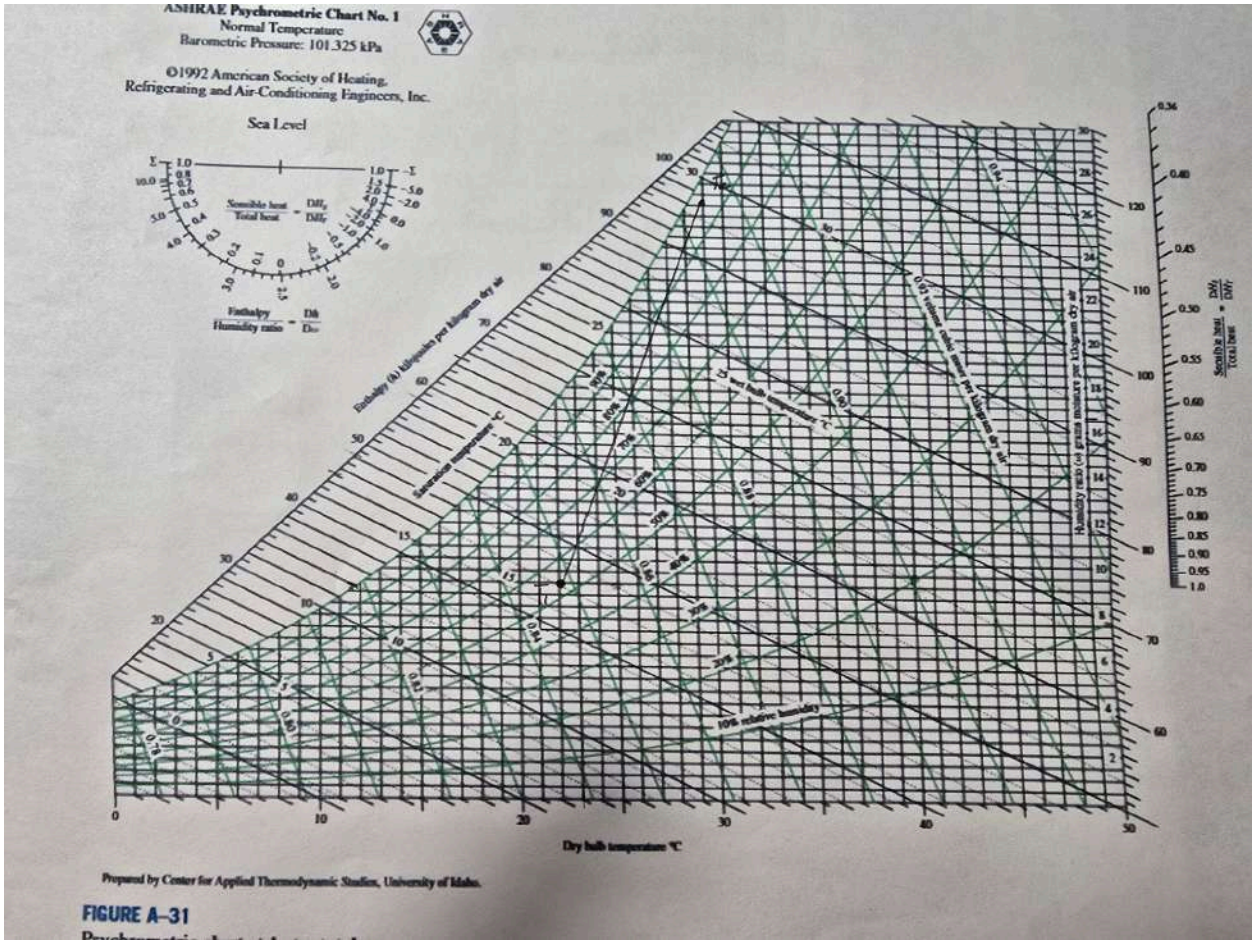

FIGURE A–31

Psychrometric for 14-109