SOLUTIONS MANUAL

THERMAL ENVIRONMENTAL ENGINEERING

THIRD EDITION

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2.1

a) $$28.75 \text{ in Hg} \left(\frac{1.450 \times 10^{-4} \text{ psia}}{2.961 \times 10^{-4} \text{ in Hg}} \right) = 14.08 \text{ psia}$$

b) $$28.75 \text{ in Hg} \left(\frac{4.019 \times 10^{-3} \text{ in } H_2O}{2.961 \times 10^{-4} \text{ in Hg}} \right) = 390.2 \text{ in } H_2O$$

c) $$\frac{390.23 \text{ in } H_2O}{0.8} \left(\frac{1 \text{ m}}{39.37 \text{ in}} \right) = 12.39 \text{ m fluid}$$

d) $$28.75 \text{ in Hg} \left(\frac{1 \text{ Pa}}{2.961 \times 10^{-4} \text{ in Hg}} \right) = 97.10 \text{ kPa}$$

2.7

The energy balance on the evaporator is

$$\dot{Q}_{1-2} = \dot{m}_{ref} (h_2 - h_1)$$

at ①, by Table A.2 SI, $h_f = 88.73$, $h_g = 1417.81 \frac{kJ}{kg}$

$$h_1 = 88.73 + 0.3(1417.81 - 88.73) = 487.45 \frac{kJ}{kg}$$

at ②, by Table A.2 SI, $h_2 = h_g = 1417.81 \frac{kJ}{kg}$

Thus

$$\dot{Q}_{1-2} = \frac{1\ kg}{s}(1417.81 - 487.45)\frac{kJ}{kg} = 930.4\ kW$$

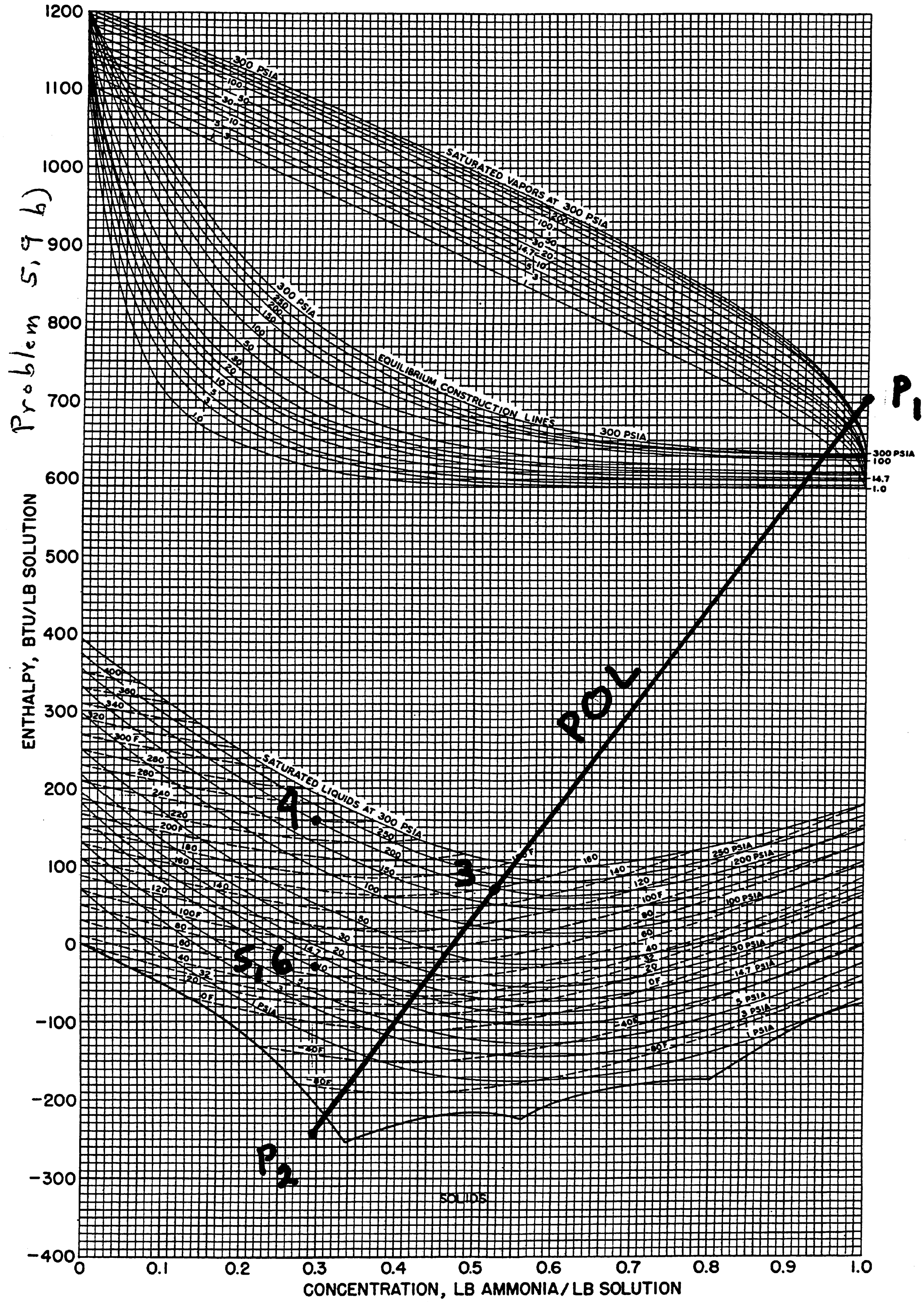
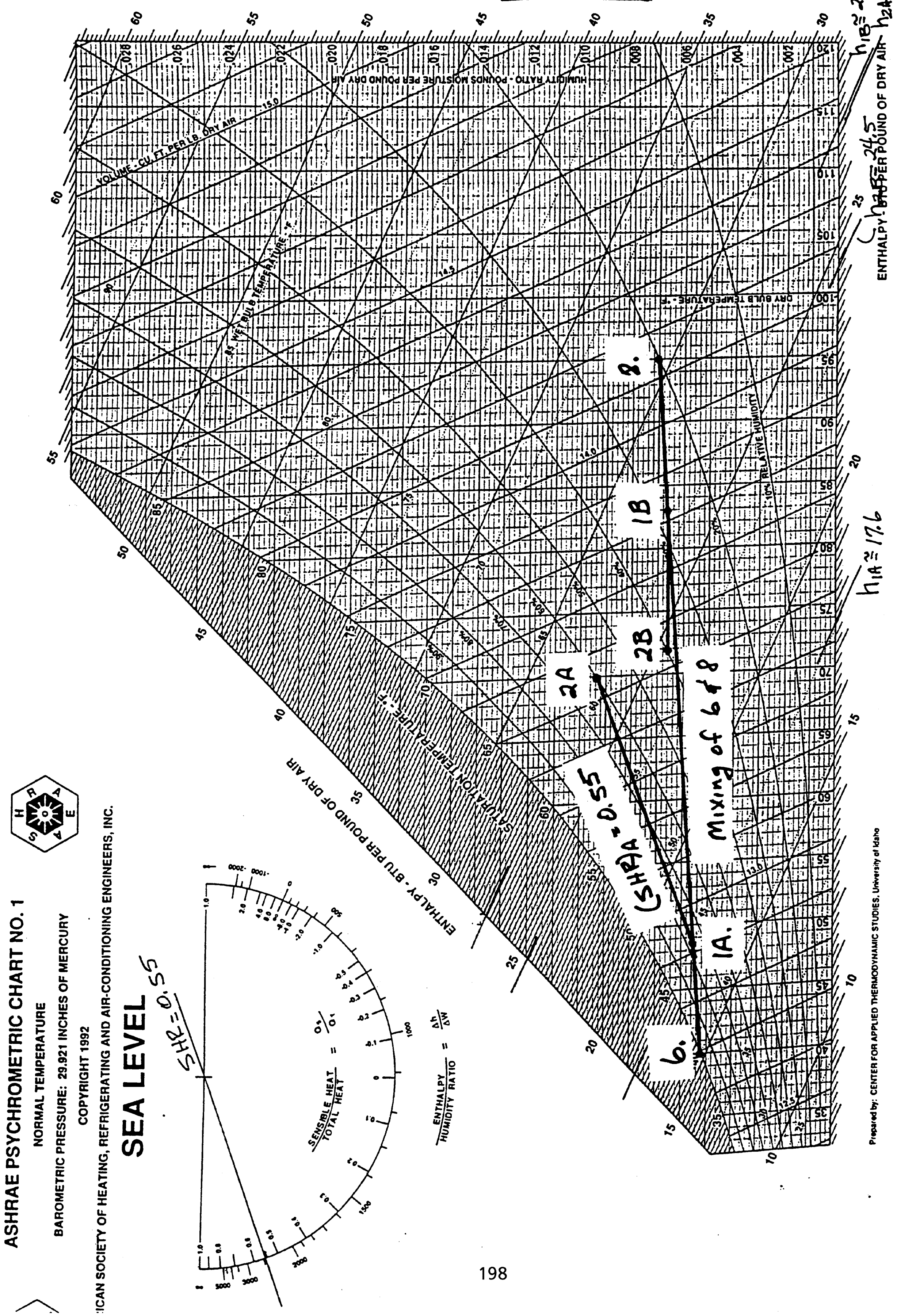

Problem 5,9 b)
ENTHALPY, BTU/LB SOLUTION
CONCENTRATION, LB AMMONIA/LB SOLUTION
SATURATED VAPORS AT 300 PSIA
EQUILIBRIUM CONSTRUCTION LINES
SATURATED LIQUIDS AT 300 PSIA
SOLIDS
POL
P1
P2
3
4
5,6

Chart C-3E

Problem 8.29


ASHRAE PSYCHROMETRIC CHART NO. 1
NORMAL TEMPERATURE
BAROMETRIC PRESSURE: 29.921 INCHES OF MERCURY
COPYRIGHT 1992
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
SEA LEVEL
SHR = 0.55
SENSIBLE HEAT / TOTAL HEAT
ENTHALPY / HUMIDITY RATIO = Δh/ΔW
ENTHALPY - BTU PER POUND OF DRY AIR
SATURATION TEMPERATURE - °F
WET BULB TEMPERATURE - °F
VOLUME - CU. FT. PER LB. DRY AIR
HUMIDITY RATIO - POUNDS MOISTURE PER POUND OF DRY AIR
DRY BULB TEMPERATURE - °F
RELATIVE HUMIDITY
ENTHALPY - BTU PER POUND OF DRY AIR
Prepared by: CENTER FOR APPLIED THERMODYNAMIC STUDIES, University of Idaho
2A
2B
1B
8.
1A.
6.
(SHR)A = 0.55
Mixing of 6 & 8
h1B ≅ 27.2
h2A ≅ 27.0
h2B ≅ 24.5
h1A ≅ 17.6

14.20 The 97.5% design temp. for Chicago is −4 °F (Table B.1)

a.) Walls

Source	Thermal Resistances, $\frac{hr\text{-}ft^2\text{-}°F}{Btu}$ At studs	Between Studs
Inside air film	0.68	0.68
3/8-inch gypsum	0.32	0.32
Studs	6.875	—
Insulation	—	19
25/32-inch sheathing	2.06	2.06
1.5-inch polystyrene*	7.5	7.5
4-inch brick **	0.6	0.6
Outside air film	0.17	0.17
Totals.	18.21	30.33

* Arbitrarily selected extruded polystyrene
** Arbitrarily selected lowest R-value/inch

Using the parallel path method, By Eqns 14.18 and 14.12

$$(U_{av})_{walls} = \frac{0.25}{18.21} + \frac{0.75}{30.33} = 0.038 \text{ Btu/hr-ft}^2\text{-°F}$$

Windows: $U_o = 0.33$ from Table 14.5

Roof: $U_R = 1/9.0 = 0.111$ Btu/hr-ft²-°F

Doors: $U_D = 0.20$ from Table 14.7

$A_{windows} = 700 \text{ ft}^2$, $A_{doors} = 40.5 \text{ ft}^2$

$A_{walls, frame} = (50)(10)(4) - 700 - 40.5 = 1259.5 \text{ ft}^2$

$A_{Roof} = 2500 \text{ ft}^2$