Homework #3 Due: 9/1

Show all work for full credit.

20 pts total

Name: Solution

1. Calculate the rate of heat loss due to transmission, infiltration, and ventilation for a 96 ft x 100 ft. single story office building. The ceiling height is 12 feet, and the maximum occupancy is 80 people. The ACH = 6.0. The required ventilation rate per person is 15 CFM. Inside temperature is 72°F and the outside temperature is 45°F. Use 3-decimals for all U-factors. Neglect the heat loss due to the flat roof.
   Round all calculations for q to whole numbers. Show all calculations for full credit.

   Complete the following:

A. Heat Loss Due to Transmission

Specifications		Calculate the U-Factor (3-decimals)
Walls	R-19 (6" insulation)	0.053
Ceilings	R-30 (10" insulation)	0.033
Windows	R-3.13	0.319
Doors	R-3.70	0.270

Floor SOG (2 in thick edge insulation, R=5)

Gross Wall Area = 2 x 96 ft x 12 ft + 2 x 100 ft x 12 ft = 2304 ft^2 + 2400 ft^2 = 4704 ft^2
Window Area = 1600 ft^2
Door Area = 320 ft^2
Ceiling Area = 9600 ft^2

Calculate the Net Wall Area = 4704 ft^2 - 1600 ft^2 - 320 ft^2 = 2784 ft^2

$q_{transmission}$ = U x A x ΔT

Building Element	U-Factor	Area (ft^2)	ΔT (°F)	q (BTUH)
Walls	0.053	2784	27	3,956
Windows	0.319	1600	27	13,802
Doors	0.270	320	27	2,335
Ceiling	0.033	9600	27	8,554
Slab = Uf x L	30 x (2 x 96 ft + 2 x 100 ft) = 30 x 392 (Using < 30 okay too)			11,760
			Total Heat Loss Due to Transmission	40,407

Continued on Back

B. Heat Loss Due to Infiltration

$q_{infililtration}$ = C x ACH x V x ΔT

= (0.018 Btu/ft^3 x °F) x (6.0 ACH) x (96 ft x 100 ft x 12 ft) x (72°F - 45°F)

= 335,923 BTUH

C. Heat Loss Due to Ventilation

$q_{ventilation}$ = 1.1 x $Q_{airflow}$ x ΔT

$Q_{airflow}$ = 15 CFM/person x 80 persons = 1200 CFM

$q_{ventilation}$ = 1.1 x 1200 CFM x (72°F - 45°F) = 35,640 BTUH

D. Calculate the Total Rate of Heat Loss for the Office Building

$q_{transmission}$	46,291 BTUH
$q_{infililtration}$	335,923 BTUH
$q_{ventilation}$	35,640 BTUH
q_{total}	417,854 BTUH