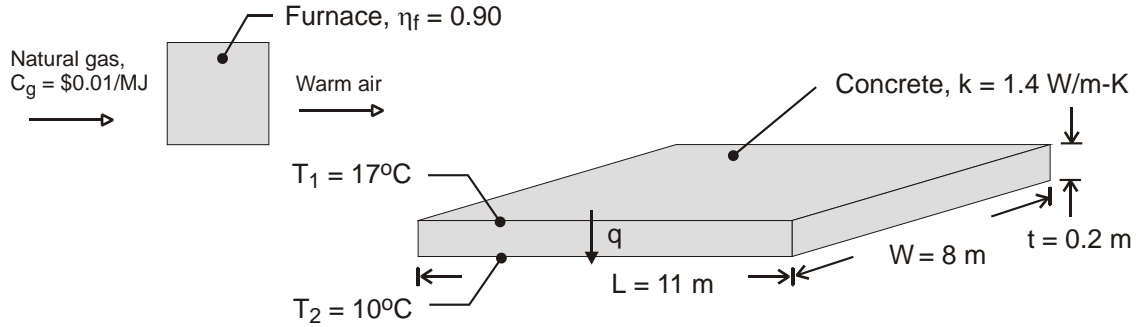


### PROBLEM 1.5

**KNOWN:** Dimensions, thermal conductivity and surface temperatures of a concrete slab. Efficiency of gas furnace and cost of natural gas.

**FIND:** Daily cost of heat loss.

**SCHEMATIC:**



**ASSUMPTIONS:** (1) Steady state, (2) One-dimensional conduction, (3) Constant properties.

**ANALYSIS:** The rate of heat loss by conduction through the slab is

$$q = k (LW) \frac{T_1 - T_2}{t} = 1.4\text{ W/m}\cdot\text{K} (11\text{ m} \times 8\text{ m}) \frac{7^\circ\text{C}}{0.20\text{ m}} = 4312\text{ W} \quad <$$

The daily cost of natural gas that must be combusted to compensate for the heat loss is

$$C_d = \frac{q C_g}{\eta_f} (\Delta t) = \frac{4312\text{ W} \times \$0.02/\text{MJ}}{0.9 \times 10^6\text{ J/MJ}} (24\text{ h/d} \times 3600\text{ s/h}) = \$8.28/\text{d} \quad <$$

**COMMENTS:** The loss could be reduced by installing a floor covering with a layer of insulation between it and the concrete.