

Chapter 16 Problem 61 †

Given

$$\text{heat loss} = 370 \text{ W}/^\circ\text{C}$$

$$T_0 = 12 \text{ }^\circ\text{C}$$

$$N = 40$$

$$P = 100 \text{ W}$$

Solution

Find the temperature inside the house during the party.

The power supplied by the guest and you is

$$P_{tot} = N \cdot P = (41)(100 \text{ W}) = 4,100 \text{ W}$$

Now considering the units of the heat loss we can conclude that

$$\text{heat loss} = \frac{P}{\Delta T} = \frac{P_{tot}}{(T_i - T_o)}$$

Solving for the inside temperature gives

$$(T_i - T_o) = \frac{P_{tot}}{\text{heat loss}}$$

$$T_i = T_o + \frac{P_{tot}}{\text{heat loss}}$$

Substituting in the known values gives

$$T_i = 12 \text{ }^\circ\text{C} + \frac{4,100 \text{ W}}{370 \text{ W}/^\circ\text{C}} = 23.1 \text{ }^\circ\text{C}$$

†Problem from Essential University Physics, Wolfson