1. The equation \( q = (U) (A) (\Delta t) \) is used to estimate which of the following:
   a. the most desirable indoor air temperature for occupant thermal comfort
   b. the design heat loss from slab-on-grade floors
   c. the design heat loss due to infiltration
   d. the design heat loss through above-ground walls, doors, windows, roofs

2. The “\( \Delta t \)” variable in the equation in question #1 represents:
   a. a statistically significant exterior air temperature that is used for design
   b. the temperature difference across a building envelope assembly (interior to exterior)
   c. the difference between the steady-state and the dynamic envelope assembly temperatures
   d. the differential thickness of insulation in a particular building envelope assembly

3. For a house in Bend, Oregon the outdoor and indoor temperatures on a winter day are: \( T_{\text{out}} = 20^\circ F \) and \( T_{\text{in}} = 70^\circ F \). A wall is constructed with the following materials. Calculate the winter heat transfer rate (BTU/hr) for one square foot of this wall. Show work, units and circle your answer.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Resistances (R) [hr ft(^2) °F / BTU]</th>
</tr>
</thead>
<tbody>
<tr>
<td>inside air film</td>
<td>0.68</td>
</tr>
<tr>
<td>gypsum board</td>
<td>0.56</td>
</tr>
<tr>
<td>batt insulation</td>
<td>17.19</td>
</tr>
<tr>
<td>air space</td>
<td>1.01</td>
</tr>
<tr>
<td>4” face brick</td>
<td>0.39</td>
</tr>
<tr>
<td>outside air film</td>
<td>0.17</td>
</tr>
<tr>
<td>( R_{\text{total}} )</td>
<td>20.0 [hr ft(^2) °F / BTU]</td>
</tr>
</tbody>
</table>

   \[ q = (U) (A) (\Delta t); \quad U = 1/20 \text{ hr ft}^2 \text{ °F / BTU} ; \quad A = 1 \text{ ft}^2; \quad \Delta t = 50^\circ F = 2.5 \text{ BTU / hr} \]
   \[ q = (U) (A) (\Delta t); \quad U = 1/20 \text{ hr ft}^2 \text{ °F / BTU} ; \quad A = 1 \text{ ft}^2; \quad \Delta t = 70^\circ F = 3.5 \text{ BTU / hr} \]
   \[ q = (U) (A) (\Delta t); \quad U = 1/20 \text{ hr ft}^2 \text{ °F / BTU} ; \quad A = 1 \text{ ft}^2; \quad \Delta t = 40^\circ F = 2.0 \text{ BTU / hr} \]

4. The term “infiltration” is correctly used to describe:
   a. outdoor air that is intentionally brought into building (as through a fan or ductwork)
   b. indoor air that escapes to the outdoors through building cracks and gaps
   c. outdoor air that unintentionally leaks into a building through gaps and cracks
   d. the long- or short-term leakage of liquid water through a vapor retarder

5. Sketch the form and describe the characteristics of a skin-load dominated building and an internally-load dominated building:

   Skin-load dominated (envelope-dominated): one with an energy-use pattern that is dominated by heat loss and gain through the building envelope.

   Internally-load dominated: a building with an energy-use pattern that is dominated by internal heat gains from lighting, equipment, and people.