

What is Energy Efficiency in HVAC Systems?

Worksheet

Energy efficiency and HVAC design aim to minimize heat loss or gain through the building envelope and mechanical systems, governed by the relationship $Q = U A T$ between insulation quality, area, and temperature difference.

Questions

1. $U=0.4$ W/mK, $A=25$ m, $T=18$ C. What is the heat loss?

- A) 180 W
- B) 18 W
- C) 720 W
- D) 7.2 W

2. A lower U-value means...

- A) worse insulation
- B) better insulation
- C) higher heat loss
- D) no effect

3. HVAC stands for...

- A) Heating, Ventilation, and Air Conditioning
- B) High Voltage AC
- C) Home Ventilation and Cooling
- D) Heat, Vapor, and Condensation

4. Doubling the temperature difference T (with U , A constant)...

- A) halves heat loss
- B) doubles heat loss
- C) has no effect
- D) triples heat loss

5. A wall has $U=0.25$ W/mK, area 40 m, and an indoor-outdoor T of 22C. Find the heat loss.

6. A window has $U=1.8$ W/mK, area 3 m, $T=15$ C. Find the heat loss through the window.

7. A building loses 600 W through a wall with $A=60$ m and $T=25$ C. Find the wall's U-value.

8. Define: What does the U-value measure?

9. Define: What is the heat loss formula?

10. Define: What is HVAC?

Answer Key

1. A) $180 \text{ W} - 0.4 \cdot 25 \cdot 18 = 180 \text{ W}$.
2. B) better insulation - U-value is thermal transmittance - lower values resist heat flow better.
3. A) Heating, Ventilation, and Air Conditioning - HVAC is the standard term for building climate-control systems.
4. B) doubles heat loss - Q is directly proportional to T, so doubling T doubles Q.
5. $Q = U A T = 0.25 \cdot 40 \cdot 22 = 220 \text{ W}$
6. $Q = 1.8 \cdot 3 \cdot 15 = 81 \text{ W}$
7. $U = Q / (A T) = 600 / (60 \cdot 25) = 0.4 \text{ W/mK}$
8. How much heat passes through a building material per m per degree of temperature difference - lower U means better insulation.
9. $Q = U A T$, where Q is heat loss in watts.
10. Heating, Ventilation, and Air Conditioning - systems that control a building's indoor climate.

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