

ARCH 4/591

QUIZ #3

Environmental Control Systems I

Department of Architecture, University of Oregon

Ady

Dianne

Matt

Sam

Name: _____

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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 “ Δt ” 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: $T_{out} = 20^{\circ}\text{F}$ and $T_{in} = 70^{\circ}\text{F}$. 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.

Materials	Resistances (R) [hr ft ² °F / BTU]
inside air film	0.68
gypsum board	0.56
batt insulation	17.19
air space	1.01
4" face brick	0.39
outside air film	0.17
R_{total}	20.0 hr ft ² °F / BTU

$q = (U) (A) (\Delta t)$; $U = 1/20$ hr ft² °F / BTU ; $A = 1$ ft²; $\Delta t = 50^{\circ}\text{F} = 2.5$ BTU / hr

$q = (U) (A) (\Delta t)$; $U = 1/20$ hr ft² °F / BTU ; $A = 1$ ft²; $\Delta t = 70^{\circ}\text{F} = 3.5$ BTU / hr

$q = (U) (A) (\Delta t)$; $U = 1/20$ hr ft² °F / BTU ; $A = 1$ ft²; $\Delta t = 40^{\circ}\text{F} = 2.0$ 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.