

**Question1:**

Define the composite wall question by finding the heat transfer rate, and then solve the same question while the thickness of the brick is increased to 32 cm and comment on the results.

**ANSWER:**

**the thickness of the brick is 16 cm**

$$Q = \frac{T_1 - T_2}{R_{total}} = \frac{20^\circ\text{C} - 10^\circ\text{C}}{6.81} = 4.405^\circ\text{C}/\text{W}$$

**the thickness of the brick is 32 cm**

$$R_{\text{inside}} = \frac{1}{h_{\text{inside}} \cdot A} = \frac{1}{10 \cdot 0.25} = 0.4^\circ\text{C}/\text{W}$$

$$R_{\text{foam}} = \frac{L_{\text{foam}}}{K_{\text{foam}} \cdot A} = \frac{0.03}{0.026 \cdot 0.25} = 4.615^\circ\text{C}/\text{W}$$

$$R_{\text{plaster}_1} = R_{\text{plaster}_2} = \frac{L_{\text{P}_1}}{K_{\text{P}_1} \cdot A_{\text{P}_1}} = \frac{0.02}{0.22 \cdot 0.25} = 0.364^\circ\text{C}/\text{W}$$

$$R_{\text{P}_{c1}} = R_{\text{P}_{c1}} = \frac{L_{\text{P}_{c1}}}{K_{\text{P}_{c1}} \cdot A_{\text{P}_{c1}}} = \frac{0.16}{0.22 \cdot 0.015} = 48.48^\circ\text{C}/\text{W}$$

$$R_{\text{brick}} = \frac{L_{\text{brick}}}{K_{\text{brick}} \cdot A} = \frac{0.32}{0.72 \cdot 0.22} = 2.02^\circ\text{C}/\text{W}$$

$$\frac{1}{R_{\text{totalplaster}}} = \frac{1}{R_{\text{P}_{c1}}} + \frac{1}{R_{\text{brick}}} + \frac{1}{R_{\text{P}_{c1}}}$$

$$\frac{1}{R_{\text{totalplaster}}} = 0.5362$$

$$R_{\text{totalplaster}} = 1.865^\circ\text{C}/\text{W}$$

$$R_{\text{outside}} = \frac{1}{h_{\text{outside}} \cdot A} = \frac{1}{40 \cdot 0.25} = 0.1^\circ\text{C}/\text{W}$$

$$R_{\text{total}} = R_{\text{inside}} + R_{\text{foam}} + R_{\text{plaster}_1} + R_{\text{totalplaster}} + R_{\text{plaster}_2} + R_{\text{outside}} \\ = 0.4 + 4.615 + 0.364 + 1.865 + 0.364 + 0.1 = 7.708^\circ\text{C}/\text{W}$$

$$Q = \frac{T_1 - T_2}{R_{total}} = \frac{20^\circ\text{C} - 10^\circ\text{C}}{7.708} = 3.892^\circ\text{C}/\text{W}$$

## Question 2:

You should solve again the simplified wall calculation procedure replacing the glass fiber one with urethane rigid foam and while replacing the fiberboard with plywood and find the two  $R_{\text{unit}}$  values.

### ANSWER:

	Wood	Insulation
Outside air	0.03	0.03
Wood bevel lapped siding	0.14	0.14
Plywood (13mm)	0.11	0.11
Glass fiber ins.	NO	$0.98 \cdot 90 / 25 = 3.53$
Wood studs	0.63	NO
Gypsum board (13mm)	0.079	0.079
Inside surface	0.12	0.12

$$R_{\text{withwood}} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = 1.109 \text{ m}^2 \cdot ^\circ\text{C}/\text{W}$$

$$R_{\text{withins}} = 0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12 = 4.007 \text{ m}^2 \cdot ^\circ\text{C}/\text{W}$$