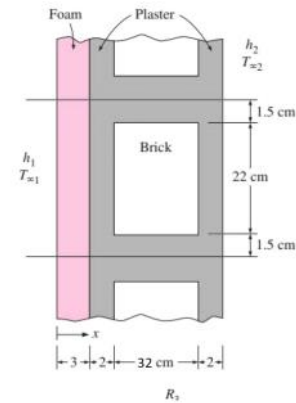


1- Heat transfer in the previous question:

Heat transfer:

$$\dot{Q} = \frac{T_1 - T_2}{R_{total}} = \frac{20 - 10}{6.81} = 1.468 \text{ W}$$



2- R total & Heat transfer while the thickness of the brick is increased to 32 cm.

$$R_{total} = R_{conv1} + R_{p1} + R_{in_{parallel}} + R_{p2} + R_{conv2}$$

$$R_{conv1} = \frac{1}{h_1 \times A} = \frac{1}{10 \times 0.25} = 0.4 \text{ C/W}$$

$$R_F = \frac{L_f}{k_f \times A} = \frac{0.03}{0.026 \times 0.25} = 4.615 \text{ C/W}$$

$$R_{p1} = \frac{L}{k_{p1} \times A} = \frac{0.02}{0.22 \times 0.25} = 0.363 \text{ C/W}$$

$$R_{parallel} = 0.0103 + 0.495 + 0.0103 = 0.515 \text{ C/W}$$

$$R_{p2} = \frac{L}{k_{p2} \times A} = \frac{0.02}{0.22 \times 0.25} = 0.363 \text{ C/W}$$

$$R_{conv2} = \frac{1}{h_2 \times A} = \frac{1}{40 \times 0.25} = 0.1 \text{ C/W}$$

$$R_{total} = 0.4 + 4.615 + 0.363 + 0.5156 + 0.363 + 0.1 = 6.3566 \text{ C/W}$$

$$\dot{Q} = \frac{T_1 - T_2}{R_{total}} = \frac{20 - 10}{6.35} = 1.573 \text{ W}$$

* The calculation of Total parallel resistance:

$$\frac{1}{R_{parallel}} = \frac{1}{R_{p1}} + \frac{1}{R_B} + \frac{1}{R_{p2}} =$$

$$\frac{1}{R_{p1}} = \frac{1}{\frac{L_P}{(K_P \times A)}} + \frac{1}{\frac{L_B}{(K_B \times A)}} + \frac{1}{\frac{L_P}{(K_P \times A)}} =$$

$$\frac{1}{R_{p1}} = \frac{1}{\frac{0.32}{(0.22 \times 0.015)}} + \frac{1}{\frac{0.32}{(0.72 \times 0.22)}} + \frac{1}{\frac{0.32}{(0.22 \times 0.015)}} =$$

$$R_{parallel} = 0.0103 + 0.495 + 0.0103 = 0.5156 \text{ C/W}$$

Note:

Increasing the thickness of the brick will not affect in the resistance of the wall section. Because it will reduce the total parallel resistance.

3- Finding the R unit values, using the simplified wall calculation procedure, with the replacement of urethane and plywood.

	Plywood	Urethane
Outside air	0.03	0.03
Wood bevel	0.14	0.14
Plywood (13 mm)	0.11	-
Urethane (90 mm)	-	$(0.98 \times 90 / 25) = 3.528$
Wood studs	0.63	-
Gypsum board	0.079	0.079

Inside surface	0.12	0.12
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$$R \text{ with plywood} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = 1.109 \text{ C/W}$$

$$R \text{ with Urethane} = 0.03 + 0.14 + 3.528 + 0.079 + 0.12 = 3.897 \text{ C/W}$$