Week 3

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Exercise：

·solve the same question while the thickness of the brick is increased to 32cm

$R_{conv,1}= \frac{1}{h_1 A} = \frac{1}{10*0.25*1} = 0.4 ^{\circ}C/_{W}$

$R_{foam}= \frac{L}{kA} = \frac{0.03}{0.026*0.25*1} = 4.6 ^{\circ}C/_{W}$

$R_{plaster}= \frac{L}{kA} = \frac{0.02}{0.22*0.25*1} = 0.36 ^{\circ}C/_{W}$

$R_{center\ plaster}= \frac{L}{kA} = \frac{0.32}{0.22*0.015*1} = 96.96 ^{\circ}C/_{W}$

$R_{brick}= \frac{L}{kA} = \frac{0.32}{0.72*0.22*1} = 2.02 ^{\circ}C/_{W}$

$R_{conv,2}= \frac{1}{h_2 A} = \frac{1}{25*0.25*1} = 0.16 ^{\circ}C/_{W}$

$$\frac{1}{R_{middle}} = \frac{1}{R_{center\ plaster}} + \frac{1}{R_{brick}} + \frac{1}{R_{center\ plaster}} = \frac{50}{96.96}$$

$R_{middle} \approx 1.94 ^{\circ}C/_{W}$

$R_{total} = R_{conv,1} + R_{foam} + R_{plaster} *2 + R_{middle} + R_{conv,2} = 7.82 ^{\circ}C/_{W}$

$Q = \frac{T_{\infty 1} - T_{\infty 2}}{R_{total}} = \frac{20 - (10)}{7.82} \approx 3.84W$ (per $0.25m^2$)

$Q_{total} = 3.84/0.25*15 = 230.4W$

Exercise:

·replacing the glass fiber one with urethane rigif foam andwhile replacing the fiberboard with plywood

Material	Thermal Conductivity
urethane rigif foam	0.021
plywood	0.13

After the circulation above, we already knew that $R_{conv,1}=0.4 ^{\circ}C/_{W}$; $R_{brick}=2.02 ^{\circ}C/_{W}$; $R_{conv,2}=0.16 ^{\circ}C/_{W}$

$R_{urethane\ rigif\ foam} = \frac{L}{kA} = \frac{0.03}{0.021*0.25*1} \approx 5.7 ^{\circ}C/_{W}$

$$R_{\text{plywood}} = \frac{L}{kA} = \frac{0.02}{0.13*0.25*1} \approx 0.62 \, ^{\circ}C/W$$

$$R_{\text{center plywood}} = \frac{L}{kA} = \frac{0.32}{0.13*0.015*1} \approx 164.1 \, ^{\circ}C/W$$

$$\frac{1}{R_{\text{middle}}} = \frac{1}{R_{\text{center plywood}}} + \frac{1}{R_{\text{brick}}} + \frac{1}{R_{\text{center plywood}}} \approx 0.507$$

$$R_{\text{middle}} \approx 1.97 \, ^{\circ}C/W$$

$$R_{\text{total}} = R_{\text{conv,1}} + R_{\text{urethane rigif foam}} + R_{\text{plywood}} * 2 + R_{\text{middle}} + R_{\text{conv,2}} = 9.47 \, ^{\circ}C/W$$