Question 1

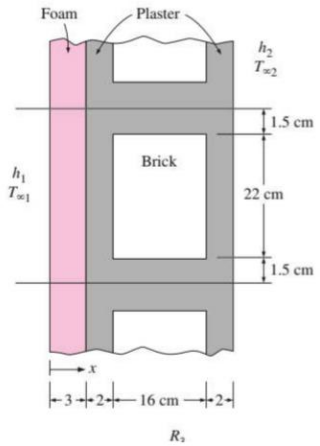
1.1 Determine the steady rate of heat transfer through this Composite wall:

Solution:

$$\dot{Q} = \frac{T_{\infty 1} - T_{\infty 2}}{R_{Total}}$$

$$\dot{\boldsymbol{Q}} = \frac{\mathbf{20 - 10}}{\mathbf{6.811}} = \mathbf{1.468\ W}$$

1.2 Solve the same question while the thickness of the brick is increased to 32 cm



Part 1

- Plaster Thickness = 0.32 m
- Area of Plaster = 0.015 m
- Area of Brick = 0.22 m
- Thickness of Brick = 0.32 m

Part 2

$$R_{pc1} = \frac{L_{pc1}}{K_{pc1} * A_{P1}} = \frac{0.32}{0.22 * 0.015} = 96.97\ \mathbf{°C/W}$$

$$R_{Brick} = \frac{L_{Brick}}{K_{Brick} * A_{Brick}} = \frac{0.32}{0.72 * 0.22} = 2.02\ \mathbf{°C/W}$$

$$R_{Total} = \frac{1}{R_{Brick}} + 2\ \frac{1}{R_{Pl}} = \frac{1}{2.02} + 2 * \frac{1}{96.97} = 0.5156\ \mathbf{°C/W}$$

Part 3

- H1 = 10 W/m2
- H2 = 40 W/m2
- R_{Cov1} = 0.4 $\mathbf{°C/W}$
- R_{Cov2} = 0.1 $\mathbf{°C/W}$
- R_{Foam} = 4.6154 $\mathbf{°C/W}$
- $R_{Plaster}$ = 0.6154 $\mathbf{°C/W}$

R_{Total} = 0.4 +0.1 +0.6154 + 0.51562 +4.6154 = 4.24642 $\mathbf{°C/W}$

Note: The R_{Total} is less when the brick was increased in thickness, although the only active material is the foam. Foam is as insulating as the whole wall. The decline in the R shows that the Bricks are not resisting the heat transfer process and shows that putting a conductive material in series not parallel resulted in decline of the $R_{Total.}$

1.3 Determine the steady rate of heat transfer through this Composite wall:

$$\dot{Q} = \frac{T_{\infty 1} - T_{\infty 2}}{R_{Total}}$$

$$\dot{Q} = \frac{20 - 10}{4.264642} = 2.355 \text{ W}$$

Question 2

Simplified wall calculation Procedure:

Material Layer	Assumption Wood	Assumption Insulation
Wood	0.03	0.03
Plywood	0.11	0.11
Urethane Rigid Foam	-	0.98
Wood Stud	0.63	-
Gypsum	0.79	0.79
Inside Air	0.12	0.12

R unit for Wood = 0.969

R unit for Insulation = 1.319