Question 1:

- you should first finalize 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:

- $R_i = \frac{1}{h1 \times A} = \frac{1}{10 \times .25} = 0.4$ ˚C/W
- $R_f = \frac{Lf}{Kf \times A} = \frac{0.03}{0.026 \times 0.25} = 4.615$ ˚C/W
- $R_{p1} = \frac{Lp}{Kp \times Ap} = \frac{0.02}{0.22 \times 0.25} = 0.36$ ˚C/W
- $R_{brick} = \frac{Lb}{Kb \times A} = \frac{0.32}{0.72 \times 0.22} = 2.02$
- $R_{pc1} = R_{pc2} = \frac{Lpc}{Kp \times Apc} = \frac{0.32}{0.22 \times 0.015} = 96.97$ ˚C/W
- $R_{p2} = \frac{Lp}{Kp \times Ap} = \frac{0.02}{0.22 \times 0.25} = 0.36$ ˚C/W
- $R_i = \frac{1}{h1 \times A} = \frac{1}{40 \times .25} = 0.1$ ˚C/W
- $\frac{1}{Rtot(p)} = \frac{1}{Rpc1} + \frac{1}{Rb} + \frac{1}{Rpc2} = \frac{1}{96.97} + \frac{1}{2.02} + \frac{1}{96.97} = 0.51$
- $R_{tot(p)} = 1.96$ ˚C/W
- $R_{tot} = 0.4+4.615+0.36+1.96+0.36+0.1=7.795$ ˚C/W

- $\dot{Q} = \frac{T1 - T\infty}{Rtot} = \frac{20-(-10)}{7.795} = 3.85$ W

Conclusion:

- By increasing the thickness of the material that is not thermal resistant like insulations the total heat resistance doesn't change so much. So it's better to improve heat resistance by using efficient insulations.

Question 2:

- Determine the overall unit thermal resistance (the *R*-value) and the overall heat transfer coefficient (the *U*-factor) of a wood frame wall that is built around 38-mm 90-mm wood studs with a center-to-center distance of 400 mm. The 90-mm-wide cavity between the studs is filled with urethane rigid foam. The inside is finished with 13-mm gypsum wallboard and the outside with 13 mm wood plywood and 13-mm 200-mm wood bevel lapped siding. The insulated cavity constitutes 75 percent of the heat transmission area while the studs, plates, and sills constitute 21 percent. The headers constitute 4 percent of the area, and they can be treated as studs.
  Also, determine the rate of heat loss through the walls of a house whose perimeter is 50 m and wall height is 2.5 m in Las Vegas, Nevada, whose winter design temperature is -2 C. Take the indoor design temperature to be 22 C and assume 20 percent of the wall area is occupied by glazing.

Answer:

Wall composition	At stud	Between stud
Outside Air	0.03	0.03
Wood bevel l.	0.14	0.14
Plywood (13mm)	0.11	0.11
Glass Fiber Ins.	____	0.98*90/25=3.53
Wood studs	0.63	____
Gypsum board	0.079	0.079
Inside surface	0.12	0.12

$R'_{\text{at stud}} = 0.03+0.14+0.11+0.63+0.079+0.12=1.109 \quad m^2\,^\circ C/W$

$R'_{\text{at stud}} = 0.03+0.14+0.11+3.53+0.079+0.12=4.009 \quad m^2\,^\circ C/W$