WEEK 4 weekly submission

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Simplified Wall Calculation

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 wall board and the outside with 13-mm 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.

	Wood (A section)	**Insulation (B section)**
Outside	*0.03*	*0.03*
Wood Bevel	*0.14*	*0.14*
Plywood	*0.11*	*0.11*
Urethane rigid foam	*No*	*0.98*(90/25)=3.53*
Wood Studs	*0.63*	*No*
Gypsum board	*0.079*	*0.079*
Inside Surface	*0.12*	*0.12*

$$R_{WOOD} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = 1.109 \frac{m2°C}{W}$$

$$R_{INSULATION} = 0.03 + 0.14 + 0.11 + 3.53 + 0.079 + 0.12 = 4.009 \frac{m2°C}{W}$$

$$U_{WOOD} = \frac{1}{R_{WOOD}} = \frac{1}{1.109 \frac{m2°C}{W}} = 0.9017 \frac{W}{m2°C}$$

$$U_{INS} = \frac{1}{R_{INS}} = \frac{1}{4.009 \frac{m2°C}{W}} = 0.2494 \frac{W}{m2°C}$$

$$U_{TOTAL} = 0.25 + U_{WOOD} + 0.75 + U_{INS}$$

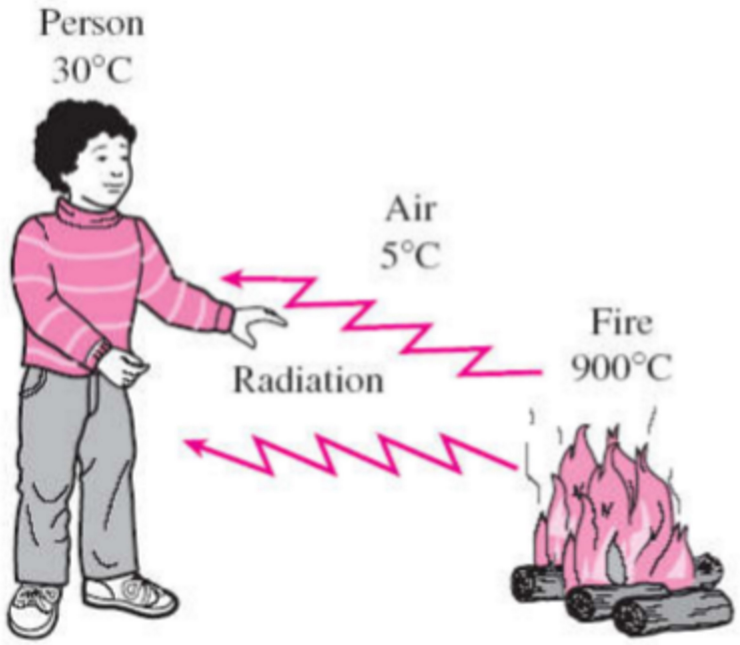
$$= 0.25 + 0.9017 \frac{W}{m2°C} + 0.75 + 0.2494 \frac{W}{m2°C} = 0.4125 \frac{W}{m2°C}$$

Overall Thermal Unit Resistance

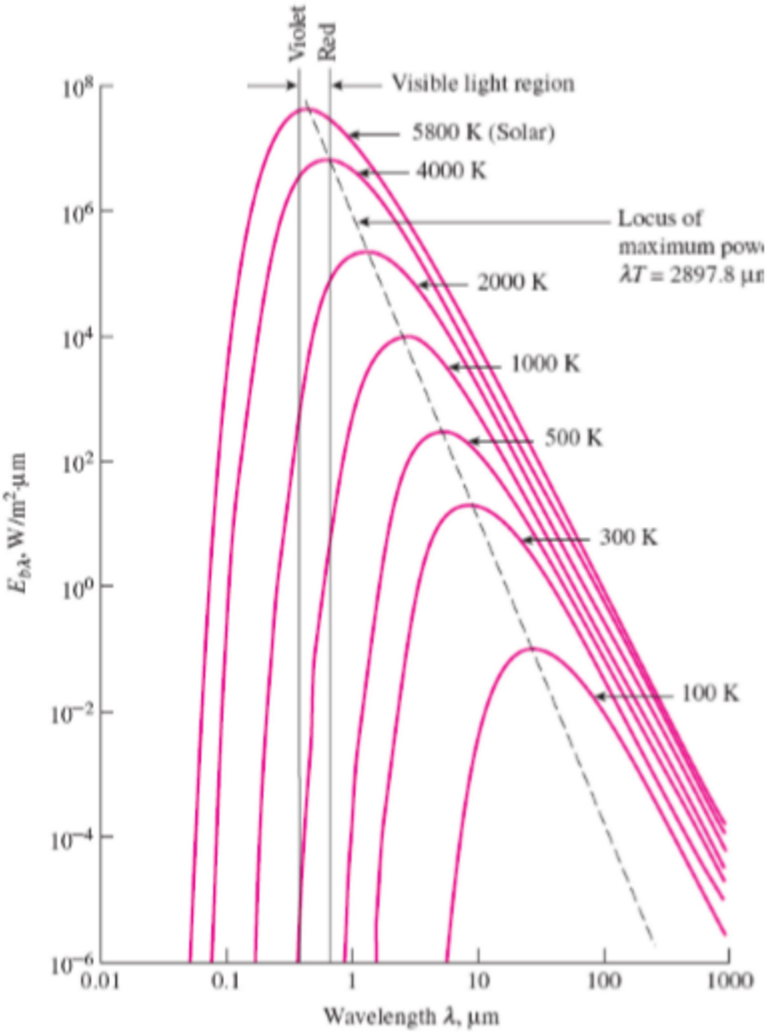
$$\mathrm{R}_{VALUE} = \frac{1}{U_{TOTAL}} = \frac{1}{0.4125} = 2.4242 \frac{W}{m2°C}$$

Heat Transfer Rate:

$$\dot{Q} = U_{TOTAL} + A_{TOTAL} + T_{DELTA} = 0.4125 \frac{W}{m2°C} + 100\,m2 + 24\,°C = 990\,W$$



- Radiation is the transfer of energy through electromagnetic waves.
- Radiation does not require any medium of matter for the heat tranfser. The main factor for radiation heat transfer is the temperature and the travel distance of radiation. The longer the distance of the radiation, the lower the temperature of heat transfer.
- On thermal radiation, radiation heat transfer occurs through vacuum, gas, or liquid.
- It is characterized by frequency or wavelength.
- It is a propagation of a collection of discrete pockets of energy called photons or quantons.
- Radiaition propagates in all direction, but the directional radiation emitted is usually not uniform.
- The longer the wavelength of the electromagnetic waves, the weaker the speed/frequency of the radiation.
- The amount of radiation increases as the temperature increases.
- Emmissive power is the result of the temperature and wavelength.
- A blackbody is a perfect emitter and absorber of radiation.
- At a specified temperature and wavelength, no surface can emit more energy than a blackbody.
- A blackbody is a diffuse emitter which means it emits radiation uniformly in all direction. Also a blackbody absorbs all incident radiation regardless of wavelength and direction.



- Radiation that is below 800K is invisible to the human eye, unless they are reflected from the other surfaces.

- The radiation emitted by the sun is roughly at 5800K and it reaches its peak in the visible region of the spectrum, and therefore is visible to the human eye.