WEEK ASSIGNMENT 4

QUESTIONS:

1 Complete the modified example of simplified wall calculations from the assignment of week 3 and find the total heat transfer through wall.

2 In 2 pages write a summary of what you have learnt about radiation and radiative heat transfer.

ANSWERS:

1.

	Wood	**Insulation**
Outside air	0.03	0.03
Wood bevel	0.14	0.14
Urethane rigid foam	/	(0.98/25)x90 = 3.53
Plywood	0.11	0.11
Gypsum board	0.079	0.079
Inside surface	0.12	0.12
Wood studs	0.63	/

R'_{wood} =0.03+0.14+0.11 + 0.079 + 0.12 + 0.63 =1.11 $\frac{m2 \cdot °C}{W}$

$R'_{insulation}$ = 0.03+0.14+3.53+0.11+0.079+0.12=4.01 $\frac{m2 \cdot °C}{W}$

$$U_{tot} = U_{ins} * \frac{A_{ins}}{A_{tot}} + U_{wood} * \frac{A_{wood}}{A_{tot}}$$

$$U_{tot} = U_{ins} * 0.75 + U_{wood} * 0.25$$

$$U_{ins} = \frac{1}{R'_{ins}} = \frac{1}{4.01} = 0.2494\ \frac{W}{m^2°C}$$

$$U_{wood} = \frac{1}{R'_{wood}} = \frac{1}{1.11} = 0.9009\ \frac{W}{m^2°C}$$

$$U_{tot} = 0.2494 * 0.75 + 0.9009 * 0.25 = 0.18705 + 0.225225 = 0.412275\ \frac{W}{m^2°C}$$

$$A_{tot} = 50 * 2.5 * 0.8 = 100m^2$$

$$\Delta T = 22 - (-2) = 24°C$$

$$Q_{tot} = U_{tot} * A_{tot} * \Delta T = 989.46\ W$$

2.

Radiation is emission or transmission of energy in the form of waves or particles through space or a material medium.

Energy transfer by radiation occurs at the speed of light and radiation can occur between two bodies separated by a medium colder than both bodies.

Electromagnetic waves transport energy just like other waves and they are characterized by their frequency ν or wavelength λ. These two properties in a medium are related by:

$$\lambda = \frac{c}{\nu}$$

c = c0 /n

c, the speed of propagation of a wave in that medium

c_0 = 2.9979ï‚´108 m/s, the speed of light in a vacuum

n, the index of refraction of that medium

n =1 for air and most gases, n = 1.5 for glass, and n = 1.33 for water

Radiation can be natural or it can be made by us, humans. We are exposed to radiation every day or by Sun, by our mobile phones, computers, etc. In some of these cases radiation can be very dangerous but it does not have to be like that all the time.

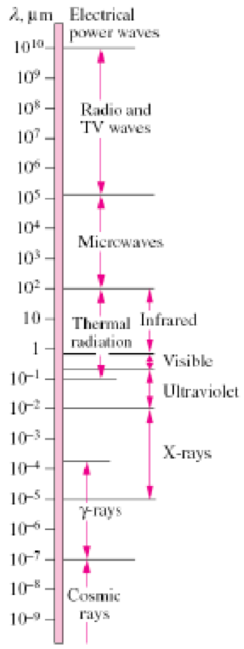
People do not see UV lights and do not know a lot of radiation that is why they face to a lot of bad influence of UV lights for example, like sun burning. And of course Sun is the most important light source.

Thermal radiation is electromagnetic radiation generated by the thermal motion of particles in matter.

In the table at the right is shown electromagnetic wave spectrum.

As it is shown thermal radiation is emitted from everything around us and in our everyday light we are exposed to a lot of radiation and on this scale are shown strengths of only some of radiations that are present.

Thermal energy is emitted in all the space where the temperature is above 0.



Light is simply the visible portion of the electromagnetic spectrum that lies between 0.40 and 0.76 µm.

TABLE 12–1

The wavelength ranges of different colors

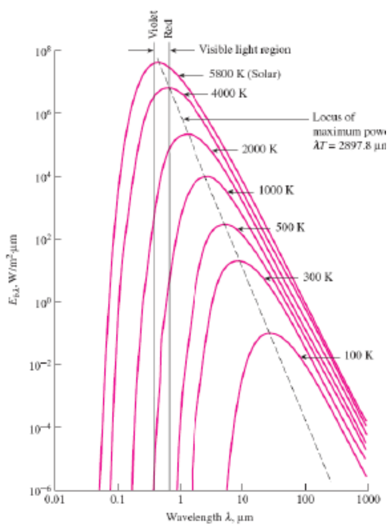
Color	Wavelength band
Violet	0.40–0.44 µm
Blue	0.44–0.49 µm
Green	0.49–0.54 µm
Yellow	0.54–0.60 µm
Orange	0.60–0.67 µm
Red	0.63–0.76 µm

In the table above we can see different colors and their wavelength ranges.

Black Body Radiation is defined as a perfect emitter and absorber of radiation. At a specified temperature and wavelength, no surface can emit more energy than a blackbody.

The radiation energy emitted by a blackbody:

$$E_b(T) = \sigma T^4 \qquad (\mathrm{W/m^2})$$



Black Body completely absorb all the radiation which is falling on it. That is why it is perfect example of radiation emitters. The main point of the Black Body is that bodies should have the same temperature as the environment, that they are equal so that the body can accept energy which is constantly received by environment.

In the diagram at the right we can see radiation of black body emissive power with wavelength for several temperatures.