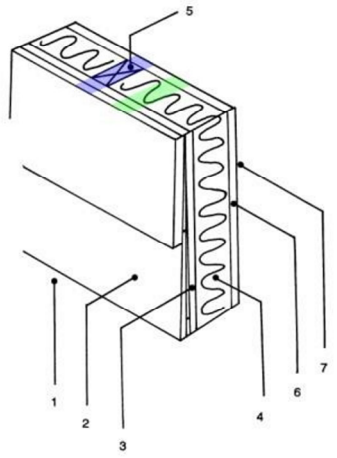
Week 4 Assignment

Thursday, December 12, 2019 7:46 PM

Task 1:

you should complete the modified example of simplified wall calculations that you went through in the assignment of week 3 and find the total heat transfer through wall



	Wood ($m^2 \cdot ℃/W$)	Insulation ($m^2 \cdot ℃/W$)
Outside air	0.03	0.03
Wood bevel 1	0.14	0.14
Plywood (13mm)	0.11	0.11
Urethane rigif foam	NO	0.98*90/25=3.528
Wood studs	0.63	NO
Gypsum board	0.079	0.079
Inside surface	0.12	0.12

$$R'_{Wood} = 0.03 + 0.14 + 0.11 + 0.63 + 0.079 + 0.12 = 1.109\ m^2.°C/W$$

$$R'_{Ins} = 0.03 + 0.14 + 0.11 + 3.528 + 0.079 + 0.12 = 4.007\ m^2.°C/W$$

$$U_{insul} = \frac{1}{R'\ insul} = \frac{1}{4.007} = 0{,}2496\ \frac{W}{m^2\ °C}$$

$$U_{wood} = \frac{1}{R'\ wood} = \frac{1}{1.379} = 0{,}7252\ \frac{W}{m^2\ °C}$$

$$U_{tot} = 0{,}2496 * 0.75 + 0{,}7252 * 0.25 = 0.1872 + 0.1813 = 0.3685\ \frac{W}{m^2\ °C}$$

$A_{tot} = 50 * 2.5 * 0.8 = 100\ m^2$ (0.8 is the 80% of the wall without glass)

$\Delta T = 22 - (-2) = 24\ °C$

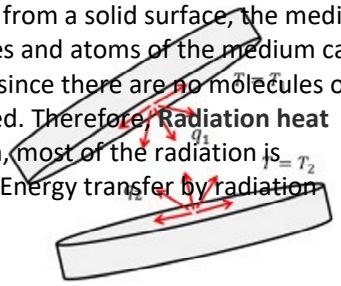
$Q_{tot} = U_{tot} * A_{tot} * \Delta T = 884.4\ W$

Task 2:

In 2 pages you should write a summary of what you have learnt in this session about radiation and radiative heat transfer

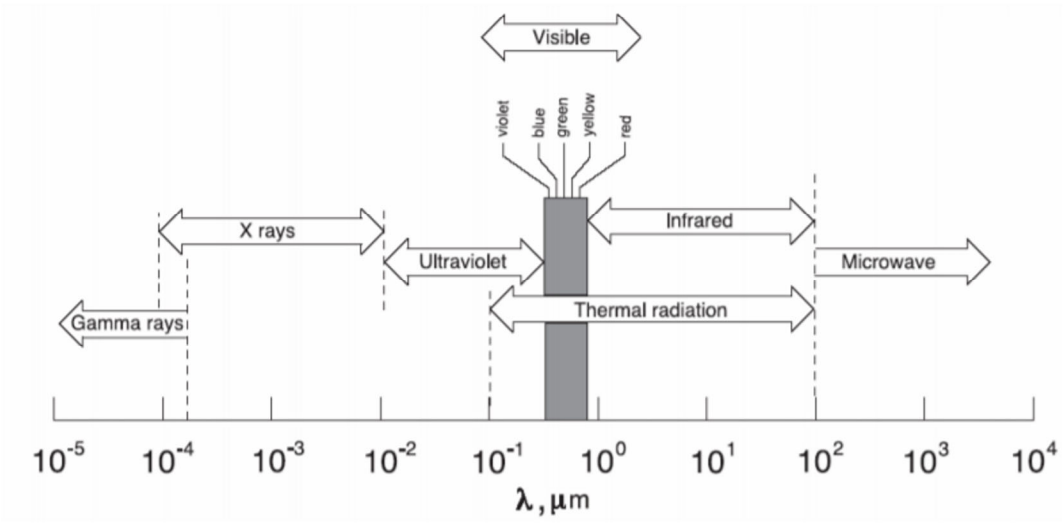
Heat radiation is the Heat transfer from a body with a high temperature to a body with a lower temperature, when bodies are not in touch with each other or when they are separated,
Its an electromagnetic phenomenon electromagnetic waves are capable of carrying energy from one location to another.

Unlike conduction and convection The heat transfer by Thermal radiation in the sense that it does not require the presence of a material medium to occur. In the case of thermal radiation from a solid surface, the medium through which the radiation passes could be vacuum, gas, or liquid. Molecules and atoms of the medium can absorb, reflect, or transmit the radiation energy. If the medium is a vacuum, since there are no molecules or atoms, the radiation energy is not attenuated and, therefore, fully transmitted. Therefore, **Radiation heat transfe**r is more efficient in a vacuum. In the case of a gas. For liquid medium, most of the radiation is absorbed is a thin layer close to the solid surface and nothing is transmitted ,Energy transfer by radiation occurs so fast like the speed of light.

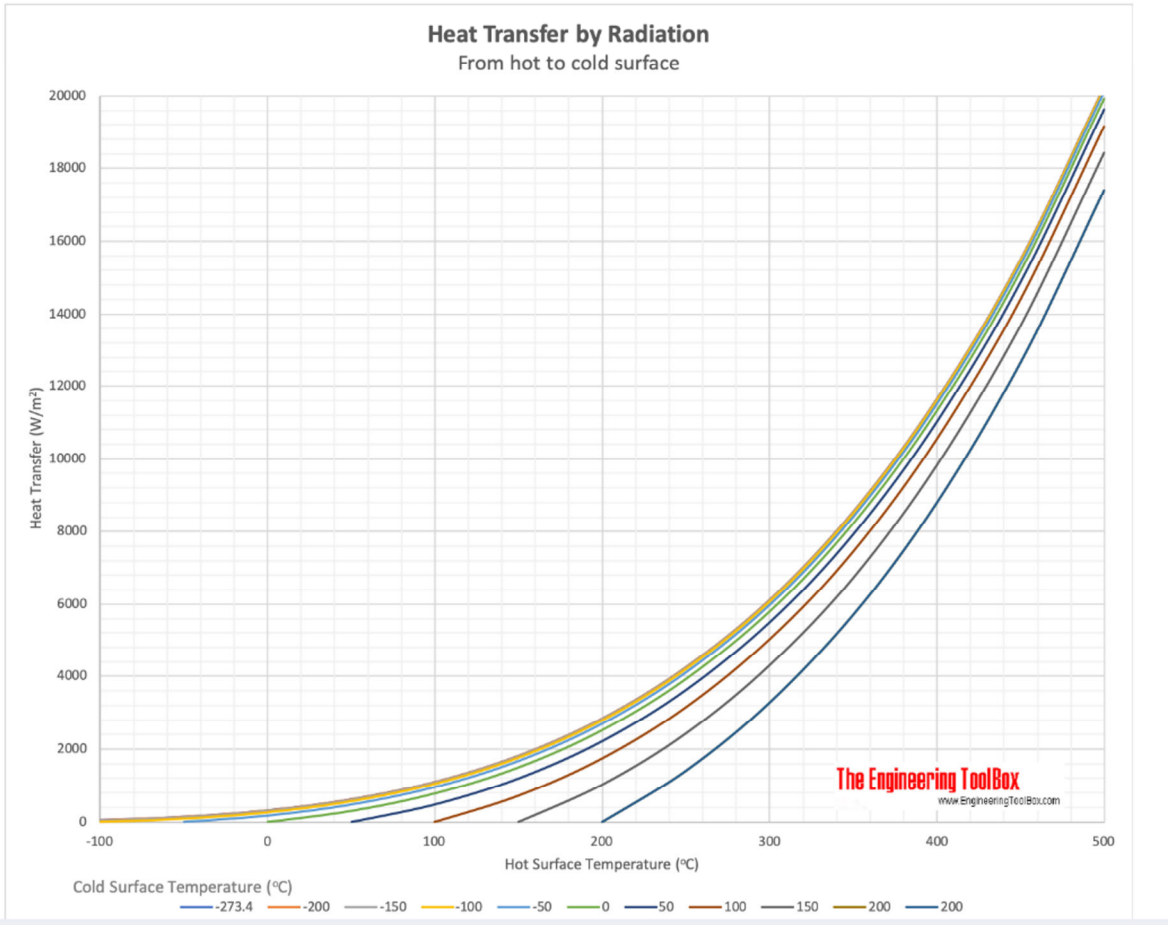


Black body: a surface that absorbs all incident radiation and reflects none .
The Stefan–Boltzmann law of thermal radiation for a black body states that the rate of radiation energy from the surface per unit area is proportional to the fourth power of the temperature of the body
$q=\sigma AT^4$

According to Maxwell theory: energy transfer takes place via electromagnetic waves in radiation. Electromagnetic waves transport energy like other waves and travel at the speed of light. Electromagnetic waves are characterized by their frequency v (Hz) and wavelength λ (μm), where: λ = c / v where c is the speed of light in that medium;
in a vacuum c0 = 2.99 x 108 m / s.



the frequency and wavelength are inversely proportional.


Heat Transfer by Radiation
From hot to cold surface
Heat Transfer (W/m²)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
-100
0
100
200
300
400
500
Hot Surface Temperature (°C)
The Engineering ToolBox
www.EngineeringToolBox.com
Cold Surface Temperature (°C)
-273.4
-200
-150
-100
-50
0
50
100
150
200
200