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

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
Urethane rigid foam	____	0.98*90/25=3.53
Wood studs	0.63	____
Gypsum board	0.079	0.079
Inside surface	0.12	0.12

R'_{wood} =0.03+0.14+0.11 + 0.079 + 0.12 + 0.63 =1.11 $m^2 \cdot °C\ W$

$R'_{insulation}$ = 0.03+0.14+3.53+0.11+0.079+0.12=4.01 $m^2 \cdot °C\ W$

$U_{tot} = U_{ins} \times A_{ins} / A_{tot} + U_{wood} \times A_{wood} / A_{tot}$

$U_{tot} = U_{ins} \times 0.75 + U_{wood} \times 0.25$

$U_{ins} = 1/ R'_{ins} = 1 / 4.01 = 0.2494$ W/m²°C

$U_{wood} = 1 / R'_{wood} = 1/1.11 = 0.9009$ W/m²°C

$U_{tot} = 0.2494 \times 0.75 + 0.9009 \times 0.25 = 0.1871 + 0.2252 = 0.4123\ W/m^2 °C$

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

$\Delta T = 22 - (-2) = 24 °C$

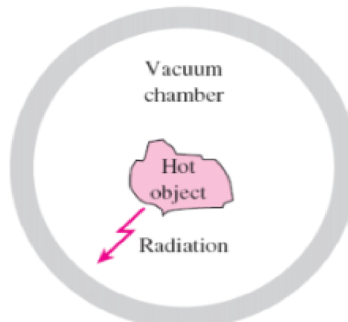
$Q_{tot} = U_{tot} \times A_{tot} \times \Delta T = 989.52$ W

Task 2: In 2 pages you should write a summary (in your own word!, in your own words !!) of what you have learnt in this session about radiation and radiative heat transfer

Answer:

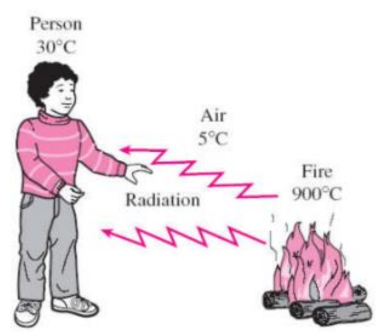
Radiation heat transfer:

In the case that there is no air and no material around hot object (that cause conduction and convection thermal transfer) the heat of the object can be transferred by radiation. Radiation heat transfer can be done in all kind of materials like gas, liquid and solid.



THERMAL RADIATION:

Heat transfer through radiation depends on the temperature can be reached to adjacent object without warming up the whole area around hot object. As you see in the example by temperature of fire the human feel 30 ˚C. However, the air between fire and human is 5˚C.



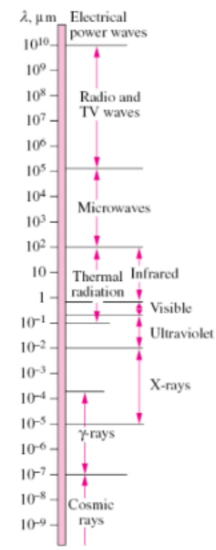
This kind of thermal transfer happens through electromagnetic waves and it depends on material and temperature. We can measure the wavelength by this formula:

$\lambda = C/V$ λ: Wavelength C: speed of light V: frequency

$C=C_0/n$ C: **speed of light** in a substance C_0: **speed of light** in a vacuum n: index of refraction $n_{gas} = 1$ $n_{glass} = 1.5$ $n_{water} = 1.33$

LIGHT:

The electromagnetic wave is ranged from 10^{-10} to 10^{10} and if the object have a temperature that emit wavelength between 0.40 and 0.76 µm (the spectrum of visible light) can be visible while heat transferring. The only materials that doesn't have thermal radiation are those that have absolute zero of temperature. So all our surrounding objects have more or less thermal radiation.



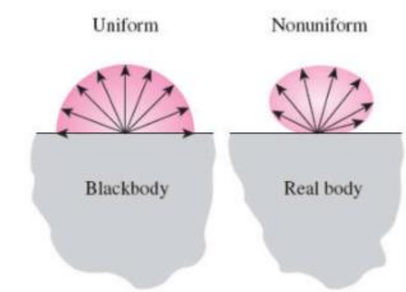
The electromagnetic wave spectrum.

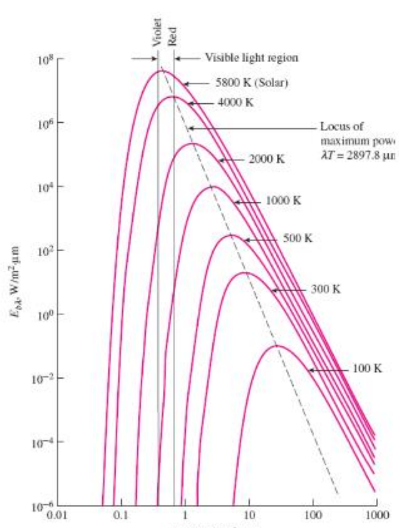
BLACKBODY:

Black body is the ideal object for emitting and absorbing radiation and it has uniform radiation in contrary with a normal object. The radiation energy by a blackbody is related to temperature. So if we raise temperature the energy of radiation will increase. But in the specific temperature and wavelength of blackbody it reaches the maximum rate of energy emitting which is: As you see in the diagram by raising up the temperature the maximum energy emission is tend to be in lower wave length.

$E_b = \sigma T^4$ W/m^2

E: radiant heat emitted from an area per amount of time T: the absolute temperature, $\sigma = 5.670367 \times 10^{-8}$ W. m^{-2}·K^{-4} is the Stefan–Boltzmann constant.





The variation of the blackbody emissive power with wavelength for several temperatures.