Week 4

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	Insulation
Outside Air	0.03	0.03
Wood bevel l.	0.14	0.14
plywood (13mm)	0.11	0.11
urethane rigif foam	No	0.098*90/25= 0.3528
Wood studs	0.63	No
Gypsum board	0.079	0.079
Inside surface	0.12	0.12
R_unit values	1.109m².c/w	0.8318
U=1/R’	0.9017	1.20221

A=50*2.5=100m²

Delta T=22-(-2) =24

U total= 0.25Uwood+ 0.75Uins

U total= (0.25*0.9017) +(0.75*1.20221)

U total= (0.2254+0.9016)

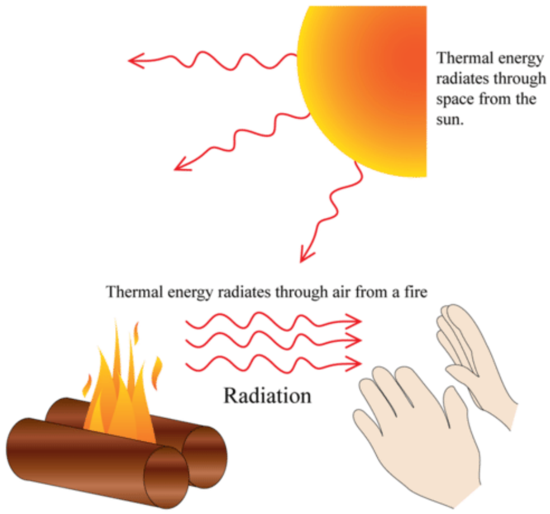
U total=1.127

Q= U total*A*(Delta T)

Q=1.127*100*24

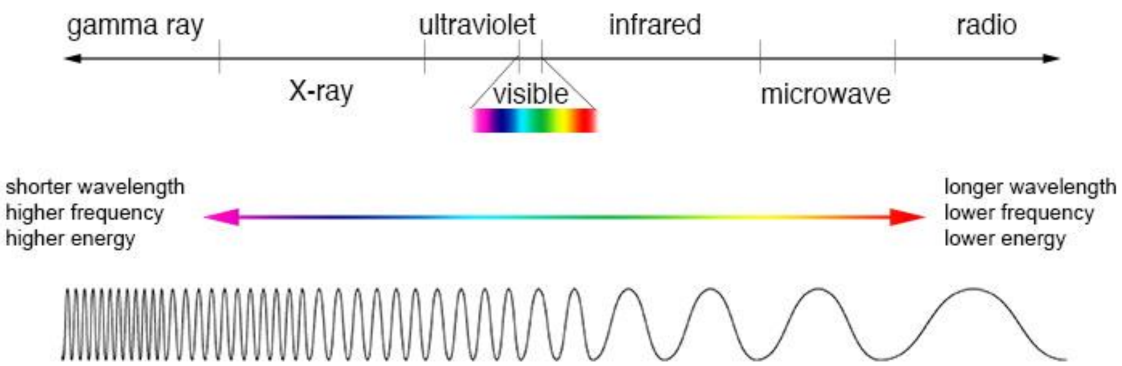
Q=2,704.8W

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



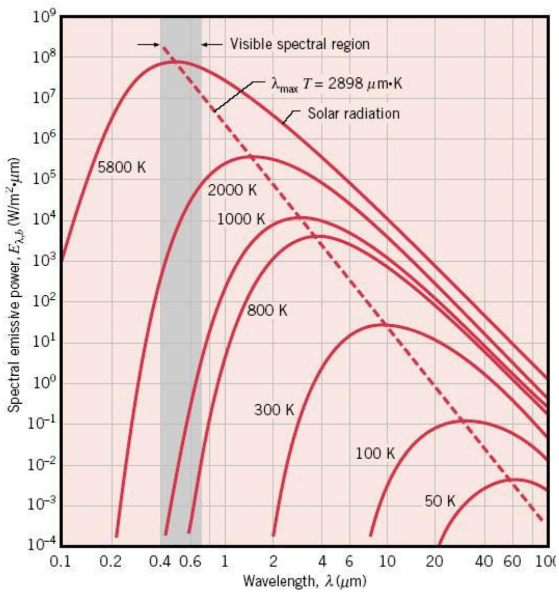
Radiation differs from Conduction and Convection heat transfer mechanisms, in the sense that it does not require the presence of a medium to occur. Energy transfer by radiation occurs at the speed of light and suffers no attenuation in vacuum. Radiation can occur between two bodies separated by a medium colder than both bodies. Such mechanism depends on the electromagnetic spectrum to transport the energy emission. Accordingly, it exhibits the same wavelike properties as light or radio waves. Each quantum of radiant energy has a wavelength, λ, and a frequency, ν, associated with it. The full electromagnetic spectrum includes an enormous range of energy-bearing waves, of which heat is only a small part.

Figure 1Comparison of wavelength, frequency, and energy for the electromagnetic spectrum.

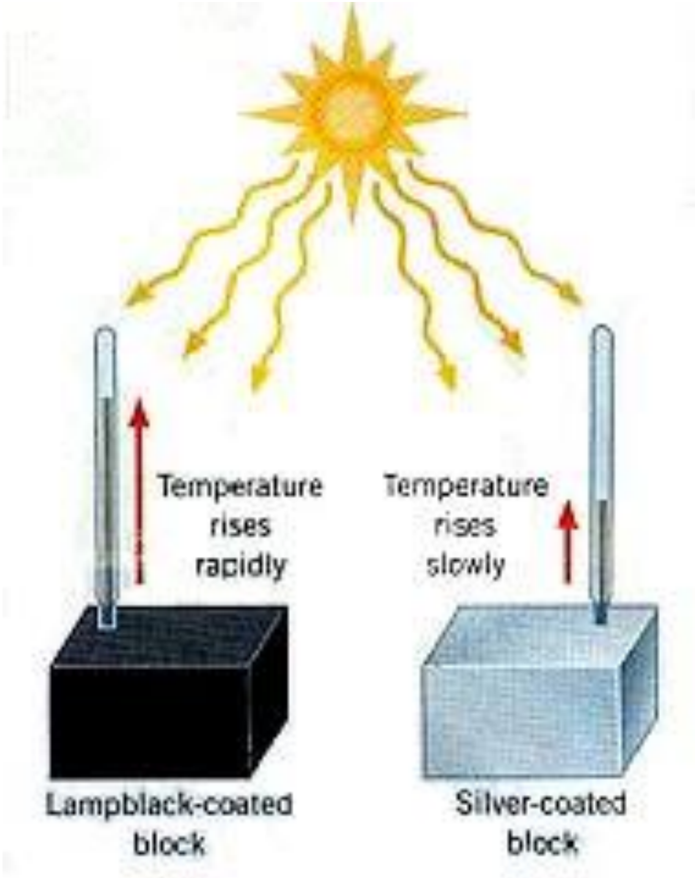


(Credit: NASA's Imagine the Universe)

Thermal radiation emission is a direct result of vibrational and rotational motions of molecules, atoms, and electrons of a substance. Temperature is a measure of these activities. Thus, the rate of thermal radiation emission increases with increasing temperature. What we call light is the visible portion of the electromagnetic spectrum which lies within the thermal radiation band. Thermal radiation is a volumetric phenomenon.



A blackbody 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. 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. The radiation energy emitted by a blackbody per unit time and per unit surface area can be determined from the Stefan-Boltzmann Law.



A blackbody can serve as a convenient reference in describing the emission and absorption characteristics of real surfaces. The emissivity of a surface is defined as the ratio of the radiation emitted by the surface to the radiation emitted by a blackbody at the same temperature. Thus, A body at temp. above absolute zero emits radiation in all directions over a wide range of wavelength. Absorb all incident radiations. Consequently, $0 \leq \varepsilon \leq 1$ Emissivity is a measure of how closely a surface approximate a blackbody, ε blackbody = 1.

The emissivity of a surface is not a constant; it is a function of temperature of the surface and wavelength and the direction of the emitted radiation, therefore, Blackbody is a diffuse emitter since it emits radiation energy uniformly in all directions.