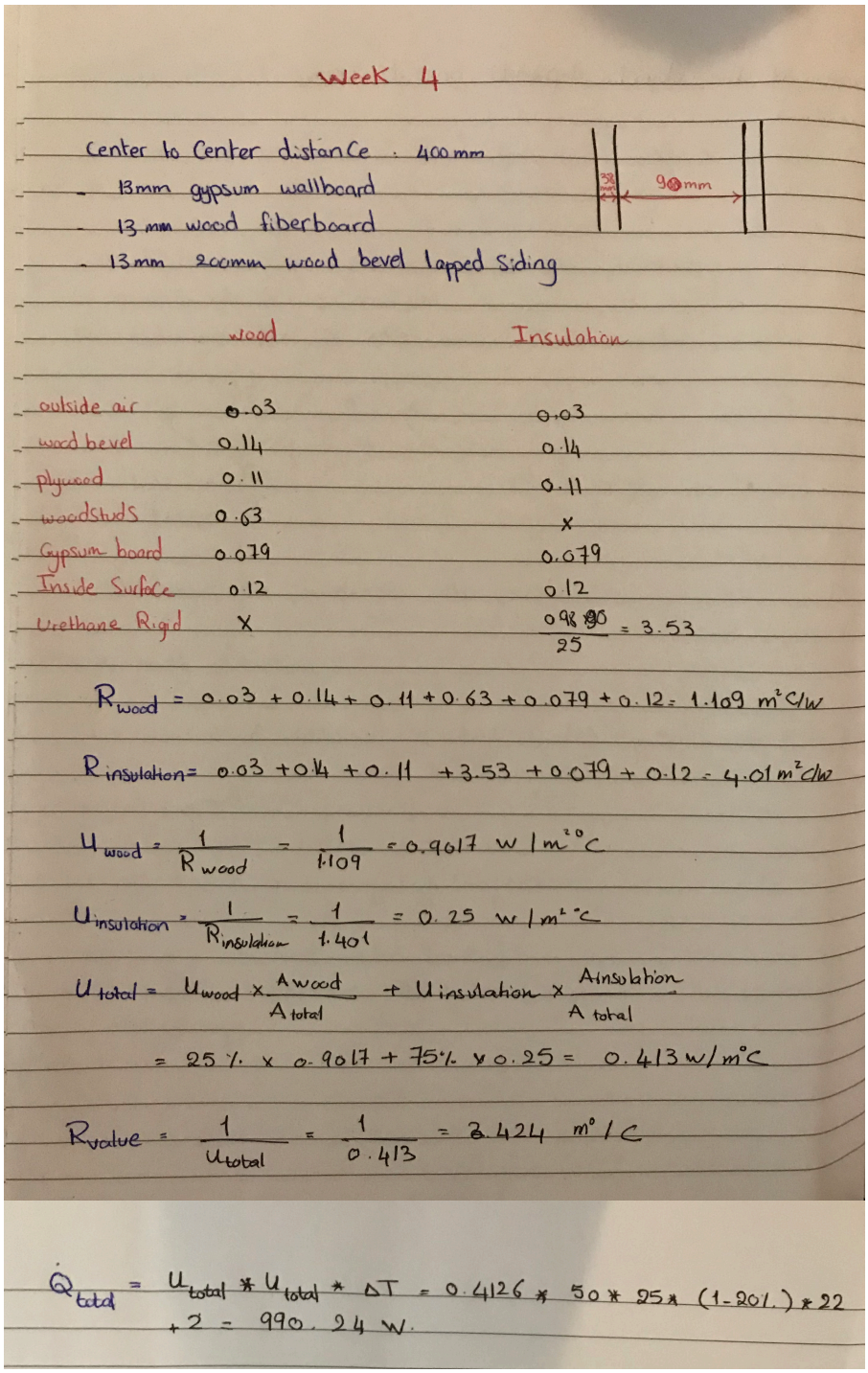
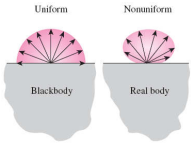


Radiation and Radiative Heat Transfer

Thermal radiation, along with convection and conduction, is a mechanism which enables bodies with varying temperature to exchange energy. It's the emission of electromagnetic waves due to thermal movement of particles of temperature more than the absolute zero. Radiation differs from conduction and convection as it does not need medium to transfer through; heat can transfer through solids as well as liquids and gases. The amount of heat radiated can differ according to the medium as the molecules of the medium can absorb, reflect or transmit the

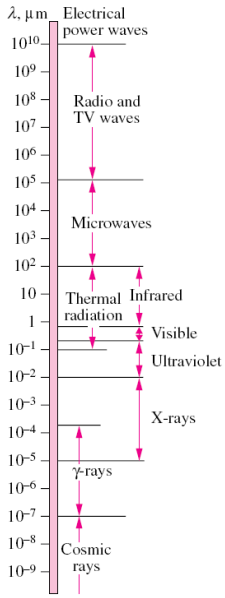
radiation. If the medium is vacuum, there's no heat loss as there is not any molecules. So, the perfect medium is vacuum.



For example, we feel the heat of the sun even though we are not touching it, that means that heat can be transmitted through empty space. This is called thermal radiation or Infrared radiation. It's concluded that the higher the temperature of the emitting object, the higher the amount of the radiation.

According to the graph:

Light is the visible portion of the electromagnetic spectrum that lies between 0.40 and 0.76 μm. A body in the visible range is called a light source. The radiation emitted by bodies at room temperature falls into the infrared region of the spectrum, which extends from 0.76 to 100 μm. The ultraviolet radiation includes the low-wavelength end of the thermal radiation spectrum and lies between the wavelengths 0.01 and 0.40 μm. Ultraviolet rays are to be avoided since they can kill microorganisms and cause serious damage to humans and other living beings. About 12 % of solar radiation is in the ultraviolet range. The ozone (O3) layer in the atmosphere acts as a protective blanket and absorbs most of this ultraviolet radiation.



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:

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

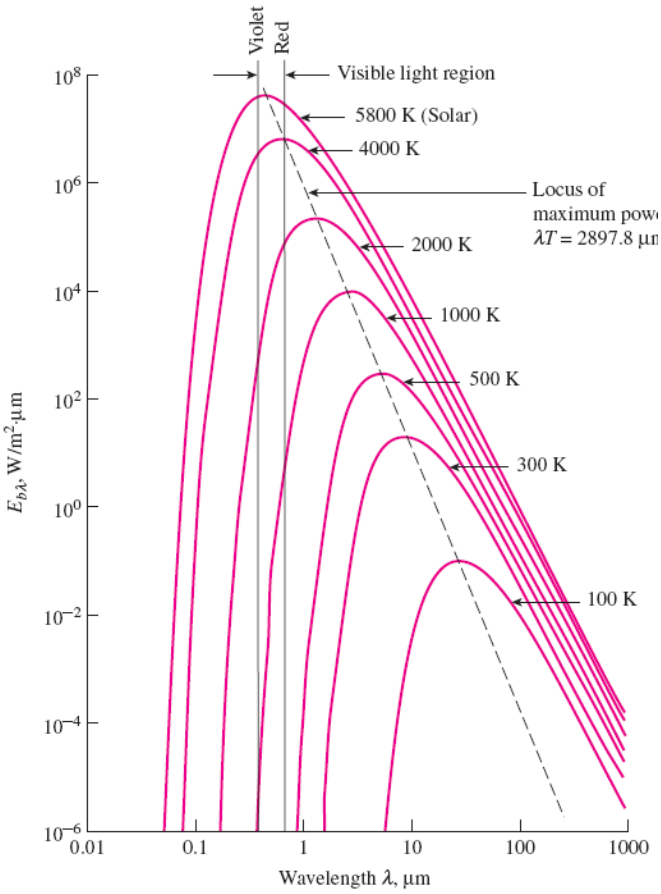
- c = C0 /n
- c, the speed of propagation of a wave in that medium
- C0 = 2.9979 x 108 m/s, the speed of light in a vacuum
- n, the index of refraction of that medium

The blackbody is the perfect emitter which emits the maximum amount of radiation per unit surface area. It differs from real objects as the radiation is uniform.

The radiation energy emitted by a blackbody:
Blackbody emissive power

$$\sigma = 5.670 \times 10^{-8}\ \mathrm{W/m^2 \cdot K^4}$$

Stefan–Boltzmann constant



The wavelength at which the peak occurs for a specified temperature is given by Wien's displacement law:

$$(\lambda T)_{\text{max power}} = 2897.8\ \mu\text{m} \cdot \text{K}$$

From the graph, we conclude that the higher the wavelength, the weaker the radiation. There is a range of temperatures within which the object can emit radiation.