Task 1

Emissivity (ε): the ratio of the energy radiated from a material's surface to that radiated a blackbody, at the same temperature, wavelength and under the same viewing conditions

Absorptivity(α): the property of a body that determines the fraction of incident radiation absorbed or absorbable by the body.

Reflectivity(ρ): the property of a body that determines the total radiations reflected by the surface at a given temp. divided by the quantity of incident radiations on the same surface.

The view factor: The view factor F12 is the fraction of energy exiting an isothermal, opaque, and diffuse surface 1 (by emission or reflection), that directly intercepted by surface 2 (to be absorbed, reflected, or transmitted).

$$F_{12} = \frac{\dot{q}_{\downarrow} emittedBySurface1AndReceivedinSurface2}{\dot{q}_{emittedBySurface1}}$$

The heat exchange between two Black surfaces:

- A blackbody is considered as a perfect emitter and absorber of radiation
- A black body is body that completely absorbs all wavelengths of thermal radiation incident on it. Such bodies do not reflect light.
- The radiation energy per unit time from a black body is proportional to the fourth power of the absolute temperature and can be expressed with Stefan-Boltzmann Law as

  $q = \sigma T^4 A$

where
q = heat transfer per unit time (W)
*σ = 5.6703 10^{-8} (W/m^2K^4) - **The Stefan-Boltzmann Constant***
T = absolute temperature in kelvins (K)
A = area of the emitting body (m^2)

The heat exchange between two Gray surfaces: is a surface which its properties are independent from wavelength. Therefore, the emissivity of a gray, diffuse surface is the total hemispherical (or simply the total) emissivity of that surface. A gray surface should emit as much as radiation as the real surface it represents at the same temperature

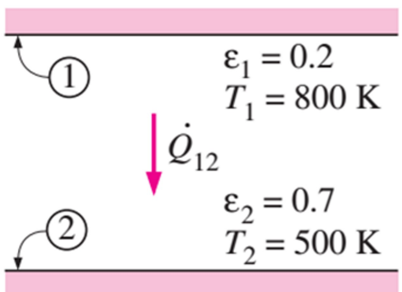
All the surfaces of the enclosure are opaque (τ = 0), diffuse and gray
- Radiative properties such as ρ, ε and α are uniform and independent of direction and frequency
- Irradiation and heat flux leaving each surface are uniform over the surface
- Each surface of the enclosure is isothermal
- The enclosure is filled with a non-participating medium (such as vacuum or air)

Radiative resistances: It is the resistance produced by the media to transfer radiation. It is found between the emissive power of the surface i and the radiosity produced by the same surface used to measure the energy produced by the loss of resistance

Task 2

Radiative heat exchange between two parallel plates

$A_1 = 1.5$ m2, $F_{12} = 0.01$, $T_1 = 298$ K, $T_2 = 308$ K, $\sigma = 5{,}67*10\text{-}8$ W/m2K 4



- When the $\epsilon_1 = \epsilon_2 = 0.1$

$$\dot{Q}'_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon'_1} + \frac{1}{\epsilon'_2} - 1} = A * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.1} + \frac{1}{0.1} - 1} = 1035.72W.A$$

- When the $\epsilon_1 = 0.2$ and $\epsilon_2 = 0.7$:

$$\dot{Q}_{12} = \frac{A\sigma(T_1^4 - T_2^4)}{\frac{1}{\epsilon_1} + \frac{1}{\epsilon_2} - 1} = A * 5.67 * 10^{-8} * \frac{800^4 - 500^4}{\frac{1}{0.2} + \frac{1}{0.7} - 1} = 3624.68\, W.A$$

Therefore, We can conclude that the emissivity is directly proportional to the radiation of heat transfer.