Task 1 In you own words (which means in your own words) write a summary of the topics about r**adiative heat transfer** we went through including the definitions of **emissivity, absorptivity and reflectivity**, the view factor, the heat exchange betweeen two black surfaces,the heat exchange between the two gray surface and finally the definition of radiative resistances

Answer1：

Radiative heat transfer

-Emissivity

The emissivity of radiative heat transfer refers to the ratio of the radiant flux emitted per unit area of the surface of the object to the radiant flux emitted by the black body under the same temperature conditions. The ratio of the absolute blackbody's radiated emissions.
The specific emissivity varies with the dielectric constant, surface roughness, temperature, wavelength and observation direction, and its value is between 0 and 1. And It can be summarized as the function of surface object type (roughness), temperature, (with the measured radiant energy) wavelength, and change with the measured radiant energy wavelength, observation Angle and other conditions.

-Absorptivity

Absorption rate is the ratio of the thermal radiation energy absorbed by an object to the object and the total radiant energy projected onto the object, so it is called the absorption rate of the object, which is the total absorption rate of all wavelengths.
The absorption rate of the surface of the object is related to the nature of the object, the surface condition and the temperature. It is an inherent property of the object itself, independent of the external environment.

-Reflectivity

The amount of radiant energy reflected by an object as a percentage of the total radiant energy is called reflectivity.
The reflectivity of different objects is also different, which mainly depends on the nature of the object itself (surface condition), as well as the wavelength of incident electromagnetic wave and incident Angle. The range of reflectivity is always less than or equal to 1, and the reflectivity can be used to judge the nature of the object

The view factor

A reflection factor is a portion of the energy emitted (radiated or reflected) from an isothermal, opaque, diffusely reflective surface that is emitted directly to another plane (absorbed or

reflected by it).

- Heat Exchange (between two Black Surfaces):

The heat exchange between two black surfaces refers to the process in which one black surface emits radiation to another black surface and is completely absorbed, while the other black surface also emits radiation and is also completely absorbed by the first black surface. Can be expressed by a formula:

The formula is: $A_1 * E_{b1} * F_{1\to 2} - A_2 * E_{b2} * F_{2\to 1}$

(A represents the area of the black surface, Eb represents the amount of radiation emitted per unit area per unit time, F represents the view factor), and applying the reciprocity relation:

$$A_1 * F_{1\to 2} = A_2 * F_{2\to 1}$$

$$\therefore \dot{Q}_{1\to 2} = A_1 * F_{12} * \sigma(T_1^4 - T_2^4)$$

- Heat Exchange (between the two Gray Surface):

The heat exchange between the two gray surfaces only absorbs and reflects a portion of the radiation (unlike the black surface). For example, when the gray surface i emits radiation to another gray surface j, the radiation that leaves the entire surface i and strikes the surface j subtracts the radiation that leaves the entire surface j and strikes the surface i. The formula that can be used is:

$$A_i * J_i * F_{i\to j} - A_j * J_j * F_{j\to i}$$

(A represents the area of the black surface, J represents the amount of radiation emitted per unit area per unit time, F represents the field of view factor), and the reciprocity relationship is applied:

$$A_1 * F_{1\to 2} = A_2 * F_{2\to 1}$$

Radiative Resistances:

Since the radiation resistance is a value for measuring the loss resistance energy, the loss energy is converted into heat radiation.

Moreover, the energy lost by the radiation resistance is converted into radio waves.

Task 2 Solve the last example you solved in the class (radiative heat exchange between two parallel plates) awhile considering the two emissivities to be 0.1, what can you conclude from the result?

Answer2：

$$\dot{Q}_{Net2\to1}=\frac{A\sigma(T_2^{\,4}-T_1^{\,4})}{\frac{1}{\varepsilon_2}+\frac{1}{\varepsilon_1}-1}=\frac{1.5*(5.67-10^{-8})*(308^4-298^4)}{\frac{1}{0.1}+\frac{1}{0.1}-1}=4.982$$

When $F_{1\to2}=0.01$

$$\dot{Q}_{net1\to2}=A_1*F_{12}*\sigma(T_1^4-T_2^4)=1.5*0.01*5.67*10^{-8}*(308^4-298^4)=-0.9466W$$

$$\because A_1=A_2$$

$$\therefore \dot{Q}_{net2\to1}=\text{-}\dot{Q}_{net1\to2}=0.9466W$$