EE580 Space Mechanisms – Quiz 4

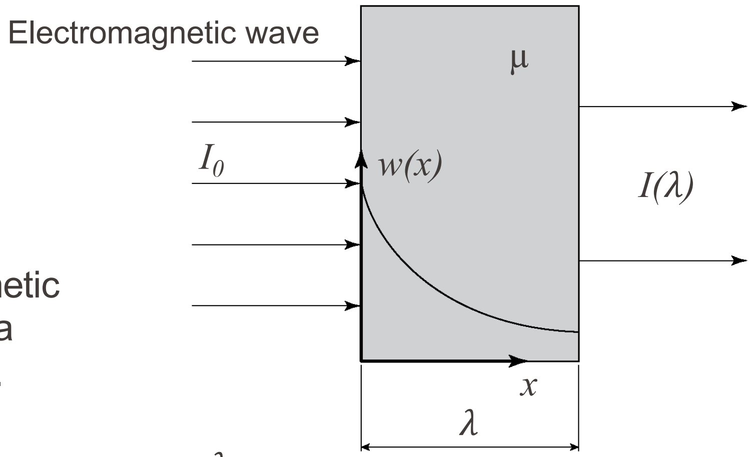
Solved

Quiz 4

- If the attenuation of radiations in a shielding follows an exponential law, what is the type of particles?

  - ~~Alpha particles~~
  - ~~Beta particles~~
  - ➢ **<u>Gamma particles</u>**

Which are also electromagnetic waves, when alpha and beta particles are mass particles.



$$I(\lambda) = I_0 \cdot e^{-\mu \cdot \lambda}$$

Quiz 4

- The dose of radiations is expressed in

  - ~~J/m²~~
  - ~~kg/m²~~

    ➢ **J/kg** $D = \frac{d\bar{\varepsilon}}{dm}$ [J/kg = Gy]

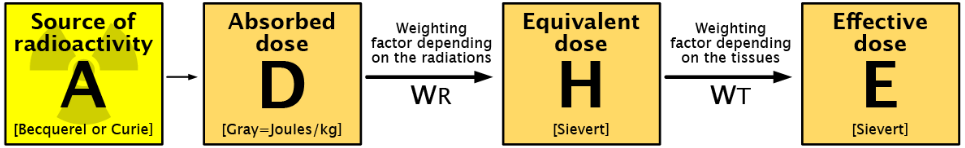
  - ~~1/ m²~~

    ➢ **Gray** [Gy= J/kg]

    ➢ **Sievert** [Sv= J/kg]

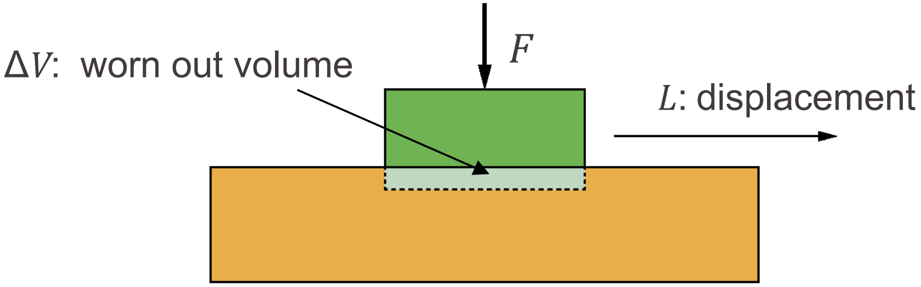
$$H_T = \sum w_R \cdot D_{T,R}$$

$$H_T = \sum w_T \cdot \sum w_R \cdot D_{T,R}$$



Quiz 4

- The wear is determined by several elements. Which one is the odd one in the following list?
  - The contact pressure between the surfaces
  - The temperature
  - The displacement speed
  - The surface condition
  - ~~The friction coefficient~~
  - The materials in contact
  - The displacement length



$$\Delta V = k \cdot F \cdot L$$

k: wear coefficient

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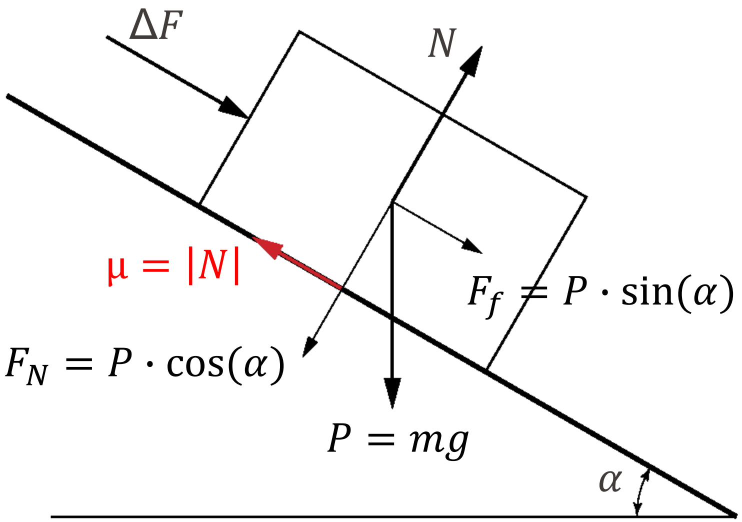
Quiz 4

- Which ratio does the friction coefficient represent?

$$F_f = \mu \cdot F_N$$

$$\mu = \frac{F_f}{F_N}$$



Quiz 4

- Thermal expansion depends on 4 parameters.
  List them here:
  - A coefficient depending on the material
    (the **coefficient of thermal expansion** α)
  - The **size of the part** at reference temperature (l_0)
  - The **reference temperature** (T_0)
  - The **temperature** (T)

$$l(T) = l_0 \cdot (1 + \alpha(T - T_0))$$

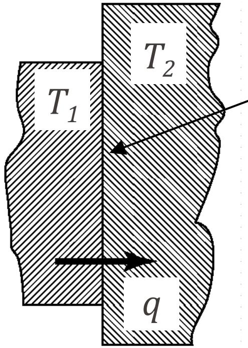
Quiz 4

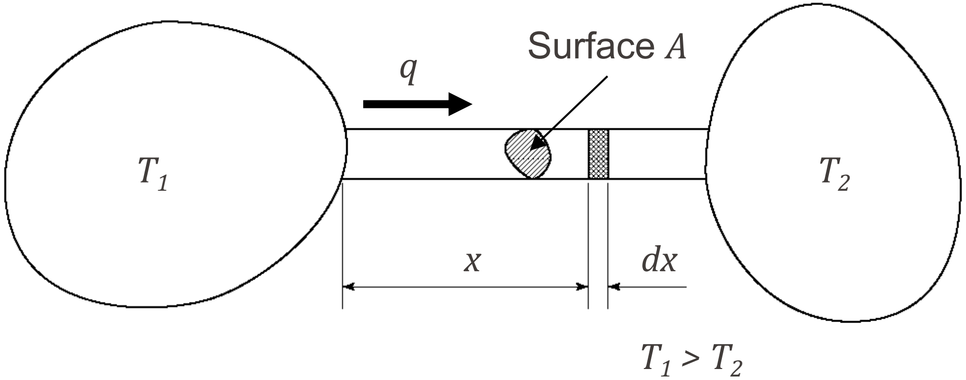
- When two parts are put into contact, two types of thermal transfer exist:

1) transfer through the surface, $[\kappa] = \dfrac{\mathrm{W}}{\mathrm{m}^2 \cdot \mathrm{K}}$ $\quad q = -\kappa \cdot A \cdot (T_1 - T_2)$

2) transfer by conduction. $[\lambda] = \dfrac{\mathrm{W}}{\mathrm{m} \cdot \mathrm{K}}$ $\quad q = -\lambda \cdot \dfrac{dT}{dx} \cdot A$

Give the units for the coefficients of both types of transfer.





Quiz 4

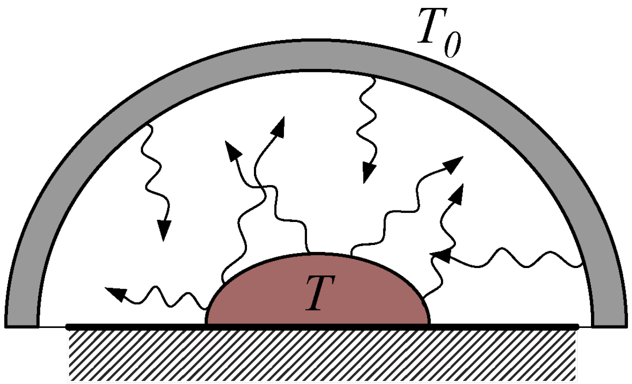
- The thermal radiation law for a grey body depends on the material and the temperature.

  - Name the parameter for the material:

    Emittance ε (émissivité)

  - Give the dependency for the temperature:

    $T^4 - T_0^4$



$$w = \sigma \cdot \varepsilon \cdot (T^4 - T_0^4)$$

Where the universal constant $\sigma = \frac{2\pi^5 k^4}{15c^2h^3} = 5.67 \cdot 10^{-8} \quad [\frac{\mathrm{W}}{\mathrm{m^2K^{-4}}}]$

Is named Stefan-Boltzmann constant

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Quiz 4

- The thermal radiation law w for a grey body is expressed as:

$$w = \sigma \cdot \varepsilon \cdot (T^4 - T_0^4)$$

- ~~A flow~~ [m³/s]
- ~~A power density~~ [W/m³]
- ➢ **<u>A power flow</u> [W/m²]**
- ~~A particle rate~~ [m/s]
- ~~A travelled distance~~ [m]

Quiz 4

- The Hertz pressure is characterized by
  - ~~3 parameters~~
  - ~~6 parameters~~
  - ~~7 parameters~~

➢ **9 parameters**

- Those parameters are:
  - The contact force F
  - The materials: E_1, E_2, ν_1, ν_2
  - The geometry: R_{1x}, R_{1y}, R_{2x}, R_{2y}