2. Thermos bottle *(6 points)* In order to study the thermal properties of a thermos bottle, let us model it as two concentric spherical vessels, with radii $R_1 = 7\,\text{cm}$ and $R_2 = 10\,\text{cm}$. The gap between the walls of the vessels contains vacuum (hence, the heat conductivity can be neglected).

i) (3,5 pt) Find the radiative heat flux (i.e. transmitted heat per unit time) between the walls of the bottle, assuming that the ambient temperature is $T_2 = 293\,\text{K}$ and the inner sphere is filled with liquid nitrogen at the boiling temperature $T_1 = 77\,\text{K}$. The emissivities of all the surfaces are equal to that of stainless steel: $\varepsilon = 0.1$. *Remark:* The emitted heat flux per unit area is given Stefan-Boltzmann's law $P = \varepsilon\sigma T^4$, where $\sigma = 5.67 \times 10^{-8}\,\text{W/m}^2\text{K}^4$ (assuming that ε is independent of the wavelength.

ii) (2,5 pt) Estimate, how long time does it take for a full evaporization of the liquid nitrogen (the vapor escapes through an over pressure valve). For the liquid nitrogen, density $\rho = 810\,\text{g/l}$ and latent heat for vaporization $\lambda = 5.580\,\text{kJ/mol}$). *NB! If you were unable to find P (for question i), express the evaporization time symbolically (i.e. using the symbol P).*