5. Plutonium decay ***(3 points)*** Plutonium is an unstable element, a Pu^{239} atom decays with a half-life of $\tau_{1/2} = 24\,000$ years by creating smaller nuclei, including an α-particle. Find the α-particle flux density (i.e the number of passing nuclei per unit time and per unit cross-sectional area) near the surface of a plate of Pu^{239}. The plate has thickness $d = 1\,\text{mm}$; its width and length are much larger than that. The density of plutonium $\rho = 19\,800\,\text{kg/m}^3$. *Remark:* half-life is the period of time it takes for a substance undergoing decay to decrease in size (in the number of particles) by half. The mass of an atom of Pu^{239} is $m_0 = 3.84 \times 10^{-25}\,\text{kg}$.