

1. Calculate the electron plasma frequencies for

- (a) a tokamak plasma with $T_e = 10^8$ K, $n_0 = 10^{19} \text{ m}^{-3}$
- (b) the tail magnetosphere with $T_e = 10^7$ K, $n_0 = 10^6 \text{ m}^{-3}$
- (c) the ionosphere with $T_e = 10^3$ K, $n_0 = 10^{12} \text{ m}^{-3}$
- (d) the solar atmosphere with $T_e = 10^4$ K, $n_0 = 10^{20} \text{ m}^{-3}$
- (e) a laser fusion plasma with $T_e = 10^7$ K, $n_0 = 10^{29} \text{ m}^{-3}$

2. Calculate the ratio of the mean free path to the Debye length for a hydrogen plasma with $mv^2/2 = 3k_B T/2$

3. Consider two infinite, parallel plates at $x = \pm d$, set at potential $\phi = 0$. The space between them is uniformly filled by a gas of number density n and of charge q .

- (a) Using Poisson's equation, show that the potential distribution between the plates is $\phi = 2\pi nq(d^2 - x^2)$
- (b) Show that for $d > \lambda_D$ the energy needed to transport a particle from a plate to the mid plane is greater than the average kinetic energy of the particles