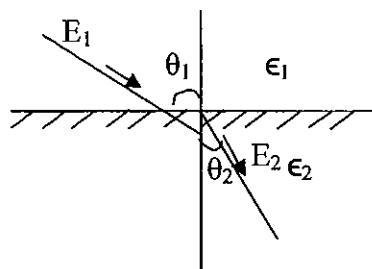
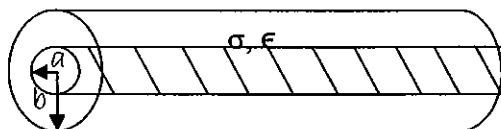


1. (10%) A point charge Q is at distance W from a conducting plane. How much energy is required to move the charge infinitely far from the plane? (please use Q, W, ϵ_0 to show the answer)
2. (10%) Three point charges all with q are located at $P(-k,0,0), Q(0,0,0)$ and $R(k,0,0)$. Find the total electric energy. (please use q, k, ϵ_0 show the answer)
3. (10%) The breakdown field strength of air is about $3 \times 10^6 \text{ v/m}$. what is the energy density at the field strength in Joule/m^3 ? ($\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$)
4. When a solid conductor of sphere shape (圓球狀), with an amount of total charges Q initially placed at its center, reaches electrostatic equilibrium,
 - (a) Describe how charges will be distributed in the conductor, and state the reason for your answer. (5%)
 - (b) Derive the intensity of the electric field inside this conductor, and state the reason for your answer. (5%)
5. An interface separates two media having permittivity ϵ_1 and ϵ_2 respectively. Assuming no charges in the system and that the intensity (E_1) and direction (θ_1) of the electric field in medium 1 are known. Please find
 - (a) the direction of the electric field in medium 2, θ_2 , based on θ_1, ϵ_1 and ϵ_2 . (5%)
 - (b) the intensity of the electric field in medium 2, E_2 , based on $E_1, \theta_1, \epsilon_1$ and ϵ_2 . (5%)



6. A coaxial cable has a length of l and a radius of a and b in its inner and outer conductor. The medium between the inner and outer conductor has a permittivity of ϵ and conductivity of σ . Please find
 - (a) the leakage resistance of the coaxial cable. (5%)
 - (b) the capacitance between inner and outer conductor of the coaxial cable. (5%)



7. (10%) From Maxwell equations in free space, derive the wave equations for the electric field and magnetic field.
8. (10%) Prove that an elliptically polarized electromagnetic wave can be composed of two orthogonally-polarized waves with unequal amplitudes.
9. (10%) What is the ratio of skin depth in Gold at $f = 10 \text{ MHz}$ and $f = 1 \text{ THz}$?
10. (10%) The SWR of a system is found to be 6.8. Please find the magnitude of the reflection coefficient in the system.