Problem 1 : The figure below shows a point charge $q = 2 \times 10^{-6}\,\mathrm{C}$, at the center of two concentric conducting shells. The first shell has a total charge Q_1, and the second shell has a total charge Q_2. These are distributed partly on the inner and partly on the outer surfaces of the respective shells. The radial component of the electric field at a point $r_1 = 1.5\,\mathrm{m}$ from the point charge and between the two conducting shells is $E_1 = -3995\,\mathrm{V/m}$. The radial component of the electric field at a point $r_2 = 3.5\,\mathrm{m}$ from the point charge and outside both shells is $E_2 = 2935\,\mathrm{V/m}$. Find the charges Q_1 and Q_2.

Problem 2 : One mole of an ideal gas at $T_1 = 200\,\mathrm{K}$ occupies $V_1 = 1\,\mathrm{L}$. It then undergoes an isothermal expansion until $V_2 = 2\,\mathrm{L}$. After this it undergoes a compression at constant pressure until $V_3 = 1.5\,\mathrm{L}$. Finally, it undergoes an adiabatic compression until its temperature returns to $T_4 = T_1 = 200\,\mathrm{K}$. Draw a diagram of the process in the p-V plane. Find (p_1, p_2, p_3, p_4), (T_2, T_3), and V_4. Also find the work done for each process (W_{12}, W_{23}, W_{34}), and the heat absorbed for each process (Q_{12}, Q_{23}, Q_{34}). Note that the complete path in the p-V plane is not a closed cycle. What is ΔE for the complete path?