2. A thin sheet of material with $\epsilon_r = 1$ lies in the xy plane and carries a periodic surface charge density given by $\sigma(x) = \sigma_0 \cos(kx)$.

    (a) What is the electric field in the region $z > 0$? [Hint: $\nabla^2 V = 0$ in free space.]

    (b) A small neutral object of polarizability α is placed at $\mathbf{r} = (0, 0, z_0)$. What is the force (magnitude and direction) on it?