Assignment 4

Posted on 19th March, Due on 28th March.

1. A spherical shell with potential $\phi(r=R)=V_0\cos\theta$. (a) Please solve the potential inside and outside the shell.
(b) if there is a point charge at the center and the potential of the shell keeps the same, solve the potential inside and outside.

2). A thick spherical shell (inner radius a, outer radius b) is made of dielectric material with a fixed polarization $P(\vec{r}) = \frac{k}{r}\hat{r}$, where k is a constant. Find the electric field in all three regions by two different methods:
(a) Locate all the bound charge and use Gauss's law
(b) Use Eq. $\oint \vec{D} \cdot d\vec{a} = Q_{free}$ to find D and then get E.

3). A point charge q is imbedded at the center of a sphere of linear dielectric material with susceptibility χ_e and radius R. Find the electric, the polarization and the bound charge densities ρ_b and σ_b. What's the total bound charge?