The potential for a solid, ungrounded, conducting sphere of radius R in an external electrical field $\vec{E} = E_0 \hat{z}$ is given by $V(r > R) = \dfrac{A}{r} - E_0 \cos\theta\left(r - \dfrac{R^3}{r^2}\right)$. This is slightly modified from the form given in lecture. Answer all parts of this problem in terms of E_0, R, θ, A and physical constants as needed.

a) Find the electric field on the surface of the sphere. Be rather careful here since the rest of the problem depends on $\vec{E}$.

b) Find the surface charge density as a function of θ.

c) Find the total charge on the sphere.

d) Find the total force (which is in the z direction) on the sphere by integrating the pressure on the sphere's surface. Hint--Is your answer consistent with the total charge you found in part c) and the fact that the sphere is in an external $\vec{E}$ field?