

Homework 4

Due October 2, 2009

272:

1.- A small sphere of radius r is placed at the center of a larger sphere of radius R . The spheres carry charges q and Q respectively, spread uniformly on their surfaces. Calculate their potential difference.

2.- On each of the three infinite planes $x=-a$, $x=0$, and $x=a$ there is a uniform surface charge of the same density σ . Find the electric field and the potential for all space, taking $V=0$ at $x=0$.

272H (the two previous and the following ones):

3.- Find the energy required to assemble four electrons at the corners of a tetrahedron of 0.1 nm on a side, surrounding a proton in the center. From the sign of the energy, what can you infer about the resultant force on one of the electrons.

4.- Calculate the exact potential at the center of a square sheet with side b of uniform charge σ assuming that $V=0$ at infinity.

Hint: Consider the following way to perform the integrals: First find the contribution to the potential at the center from a narrow strip of width dx running from $y=-x$ to $y=x$ (diagonals on the square). Then integrate over x to get the contribution of that quarter of the square.