Problems for HW 3

C. Gwinn

Due 20 Oct 2009, 5 pm

1 HW3 Problem 1

6 equal charges $+q$ are placed at $\pm a$ on the $x-$, $y-$ and $z-$axes.

\[ \begin{align*}
+q & \quad +q \\
+q & \quad +q \\
+q & \quad +q \\
+q & \quad +q \\
+q & \quad +q \\
+q & \quad +q
\end{align*} \]

a) Find the electrostatic energy of the configuration.

b) What is the potential at the origin?

c) What charge $-Q$ would you have to place at the origin so that the total energy of the charge distribution is zero?

2 HW3 Problem 2

Sometimes the surface of water carries a charge. Here is a simple model for a charged bubble floating on the surface of the charged water.
An infinite sheet of charge has surface charge density $\sigma$. A sphere of charge, of radius $a$ and also with surface charge density $\sigma$, lies with its equator at the plane. No charge density lies within the sphere: the sheet’s surface charge ends at the surface of the sphere.

Find the potential $V$ as a function of height above the center of the sphere, both inside and outside. Sketch $V(z)$. What boundary conditions must $V(z)$ satisfy at $z = 0$ and $z = a$?

3 Problems from Griffiths

2.32, 2.36, 2.37, 2.39, 2.46