# Problem Set 3: Electrical Energy

Instructions:

1. Answer all questions below. Show your work for full credit.
2. Due before the end of the day, 15 July 2009
3. Email: leclair.homework@gmail.com; hard copies: Gallalee 110 or Bevill 228.
4. You may collaborate, but everyone must turn in their own work

1. A sphere the size of a basketball (radius 0.12 m) is charged to a potential of -500 V. About how many extra electrons are on it, per cm^2 of surface?

2. A positive charge of q and a negative charge of $-4q$ are placed a distance d apart. Taking the zero for electric potential to be an infinite distance from both charges, find another point where the electric potential is zero.

3. A single atomic layer of singly-charged ions (charge $+e$) can be arranged on a neutral insulating surface in one of two ways: either as a square or a triangular lattice. For four ions in the former configuration, and three in the latter, calculate the potential energy *per unit charge*. Which lattice is more stable?
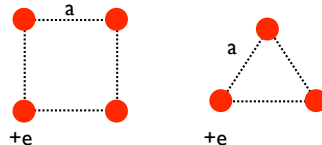
4. The gap between the electrodes of a spark plug in an automobile is 0.64 mm. In order to produce an electric field of 3×10^6 V/m required to initiate a spark, what minimum potential difference must you apply to the plug?

5. An electron in a neon light tube is accelerated from rest through a 2000 V potential difference. What velocity does the electron attain?

6. Find the equivalent capacitance for *both* combinations shown below. Be sure to consider the symmetry involved and the relative electric potential at different points in the circuits.