**SP 212 Section 4341**
**Dr. Morgan**
**Problem Set #1**
**Due: Friday, January 9**

1. A crystal of NaCl (common salt) consists of a regular arrangement of ions of $Na^+$ and $Cl^-$. The distance from one ion to its neighbor is $2.82 \times 10^{-10}$ m. What is the magnitude of the electric force of attraction between the two ions? Treat the ions as point charges.

2. How many electrons do we need to remove from an initially neutral bowling ball to give it a charge of +1 C?

3. In the lead atom, the nucleus has an electric charge 82*e*. The innermost electron in the atom is typically at a distance of $6.5 \times 10^{-13}$ m from the nucleus. What is the electric force that the nucleus exerts on such an electron? What is the acceleration that this force produces on the electron? Treat the electron as a classical particle.

4. A small charge of $2 \times 10^{-6}$ C is at the point $x = 2,\ y = 3$ m in the $x - y$ plane. A second small charge of $-3 \times 10^{-6}$ is at the point $x = 4,\ y = -2$ m. What is the electric force that the first charge exerts on the second? What is the force that the second charge exerts on the first? Express your answers as vectors, with *x* and *y* components (express using the unit vectors $\hat{i}$ and $\hat{j}$).

5. Point charges $Q$ and $-Q$ are separated by a distance *d*. A point charge *q* is equidistant from these charges, at a distance *x* from their midpoint. What is the electric force on *q*?

Answers:

1. 2.89 x $10^{-9}$ N
2. 6.3 x $10^{18}$ electrons
3. 0.045N; 4.9 x $10^{28}$ m $sec^{-2}$
4. $(-6.9\times10^{-4}\,\hat{i}+1.7\times10^{-3}\,\hat{j})$ N; $(6.9\times10^{-4}\,\hat{i}-1.7\times10^{-3}\,\hat{j})$ N
5. $F_z = -\dfrac{1}{4\pi\varepsilon_0}\dfrac{qQd}{(x^2+d^2/4)^{3/2}}$