Report 3:

Coulomb's Law:

"The magnitude of the electrostatic force between two point charges is directly proportional to the magnitudes of each charge and inversely proportional to the square of the distance between the charges."

When one is interested only in the magnitude of the force (and not in its direction), it may be easiest to consider a simplified, scalar version of the law

$$F = k\frac{|q_1||q_2|}{r^2}$$

k is the electrostatic constant or **Coulomb force constant**, often written as $\frac{1}{4\pi\epsilon_0}$ where ϵ_0 is a physical constant, the permittivity of free space. $k \approx$ 8 987 742 438 $F^{-1} \cdot m$ or $C^{-2} \cdot N \cdot m^2$, and $\epsilon_0 \approx 8.854 \times 10^{-12}$ $F \cdot m^{-1}$ or $C^2 \cdot N^{-1} \cdot m^{-2}$. In cgs units, the unit charge, **esu of charge** or statcoulomb, is defined so that this Coulomb force constant is 1.

Note that $\frac{1}{\mu_0 \epsilon_0} = c^2$, where μ_0 is the permeability of vacuum and c is the speed of light

What are the range of the chemical potential of the electrons for which a given charge state is thermodynamically most stable? This question can be tackled by attempting to calculate the formation energy for each charge state:

$$E^f(X,q) = E^t(X,q) - \left(\sum_{\text{atoms}} \mu_i\right) + q\left\{E_v(X,q) + \mu_e\right\} + \xi(X,q)$$

Therefore, if we assume that the particles can move freely between positions, they are more likely to be found in a gas-like state than in a solid-like state.