Coulomb's Law

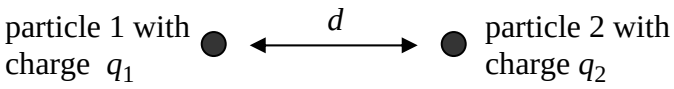
Consider two stationary particles with charges q_1 and q_2 separated by a distance d. According to Coulomb's law, the force of attraction between the particles, F, is

$$F = \frac{kq_1q_2}{d^2}$$

where k is a constant. The potential energy, V, of this attractive force is the product of the force of attraction and distance; thus

$$V = \frac{kq_1q_2}{d}$$

Pictorially, we have this model



Questions to Consider

What happens to the potential energy if we increase the distance between the particles? Explain your reasoning.

What happens to the potential energy if the particles are infinitely far apart? Explain your reasoning.

Assuming that d has a finite value (that is, it isn't infinity), what must be true if the potential energy is negative? Explain your reasoning.

If q for an electron is –1, what are the values of q for a proton and a neutron? What is q for the nucleus of an atom of ^{14}N?

An atom of ^{1}H has a nucleus with a single proton and a single electron a distance d from the nucleus. Is the potential energy between the nucleus and the electron positive or negative? If you move the electron further from the nucleus, what happens to the potential energy? Can you extend this conclusion to other atoms? For each question, explain your reasoning.