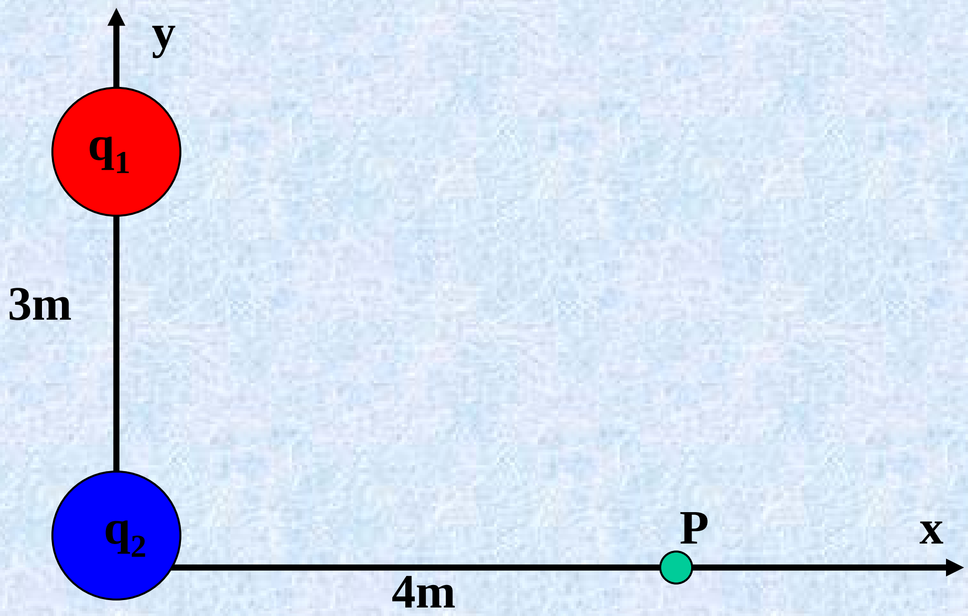
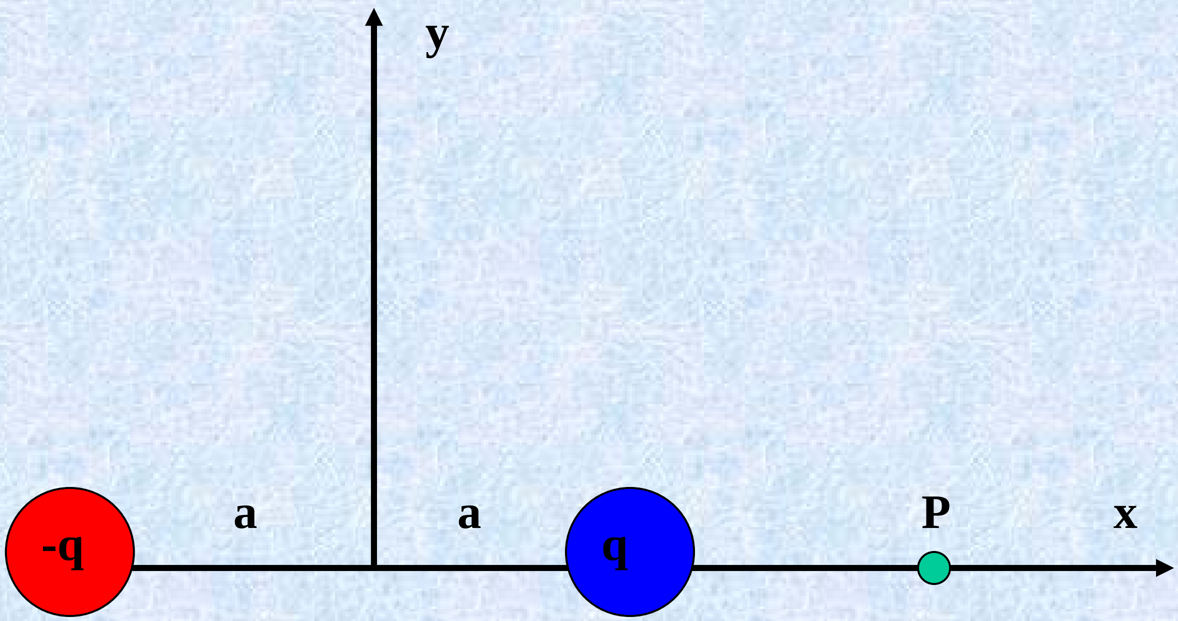


What is the total electric potential at point P due to the two point charges if q_1 = -6μC and q_2 = 2μC?

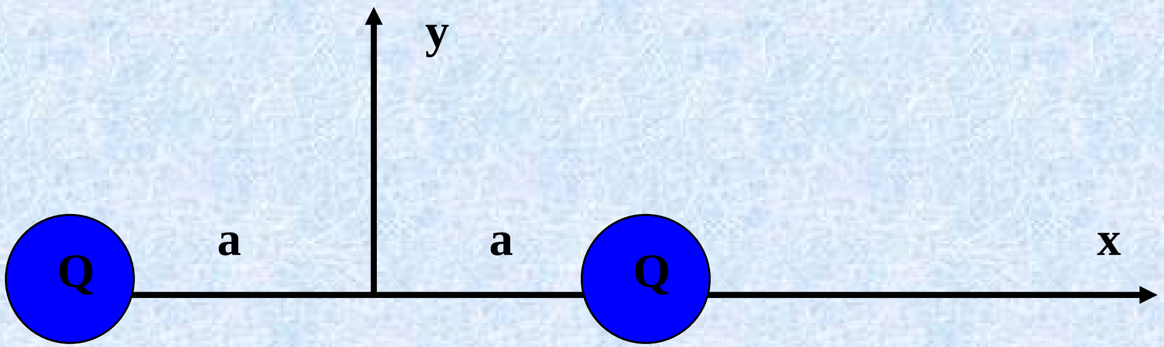
How much work is done moving a charge q = 3μC from infinity to point P?



What is the electric potential at a point P along the x-axis due to the electric dipole centered on the origin?

What is the electric potential if point P is very far away from q?

What would the result be if point P were moved the same distance to the left of the negative charge?

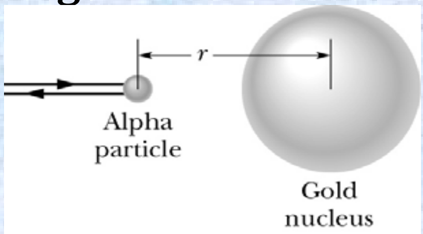


If $a = 0.8$m and $Q = 2\mu C$ with a positive test charge $q = 1.28\times10^{-18}$ C located at the origin, what is the net force on the test charge due to the charges Q?

What is the electric field at the origin due to the charges Q?

What is the electric potential at the origin due to the charges Q?

An alpha particle (which contains 2 protons and 2 neutrons) passes through the region of electron orbits in a gold atom, moving directly toward the gold nucleus, which has 79 protons and 118 neutrons. The alpha particle slows and then comes to a momentary rest, at a center-to-center separation $r = 9.23\text{x}10^{-15}$m before it begins to move back along its original path. (This technique is called *Rutherford Backscattering Spectroscopy* and the alpha particles are usually accelerated using a particle accelerator, like the one we have in the basement of Science and Engineering!)



a) What was the initial kinetic energy of the alpha particle when it was initially far away, external to the gold atom?

b) Given the kinetic energy in part a), through what potential difference was the alpha particle accelerated?

c) How much work was done on the alpha particle in accelerating it through the potential difference in part b?

d) The Union College Pelletron particle accelerator 1.1MV tandem electrostatic accelerator. When using this machine alpha particles are accelerated two times in succession (hence the tandem) and interact with the nucleus of a gold atom. Supposing that the alpha particles reach an energy of 3.3MeV using the Pelletron accelerator, what will the center-to-center separation of the alpha particle and the gold nucleus?

How much work does it take to assemble 3 point charges of equal magnitude (q = 2μC) on the vertices of an equilateral triangle (with sides of length 2m)?

In lightning storms, the potential difference between the Earth and the bottom of the thunderclouds can be as high as 35,000,000 V. The bottoms of the thunderclouds are typically 1500 m above the Earth, and can have an area of Modeling the Earth-cloud system as a huge capacitor, calculate (*a*) the capacitance of the Earth-cloud system, (*b*) the charge stored in the "capacitor," and (*c*) the energy stored in the "capacitor."

Two conductors having net charges of $\pm$ 10μC respectively have a potential difference of 10V.

What is the capacitance of the system?

What is the potential difference between the two conductors if the charges on each are increased to $\pm$ 100μC?

How many electrons flow onto a parallel plate capacitor that has a capacitance of 9 μF and is connected to a 12 V battery?

What is the capacitance of a pair of circular plates that each have a diameter of 10 cm separated by 2.2 mm of paper (κ = 4)?

A cell membrane can be modeled as a capacitor. What is the magnitude of the electric field across a cell membrane if it is 1.10×10^{-8} m thick and the potential difference across the membrane is -70 mV?

A rather hard question: When an air-filled parallel plate capacitor is connected across a battery it acquires a charge on each plate q_0 = 6 μC. With the battery connection maintained, a dielectric slab is inserted into and fills the region between the plates. This results in the accumulation of an additional charge q = 4 μC on each plate. What is the dielectric constant of the slab?

Another rather hard question:

Plate *a* of a parallel-plate air-filled capacitor is connected to a spring having force constant *k*, and plate *b* is fixed. They rest on a table top as shown below. If a charge +Q is placed on plate *a* and –Q is placed on plate *b*, by how much does the spring expand?